THE

AMERICAN JOURNAL OF PHARMACY.

OCTOBER, 1843.

ART. XXXIX.—A NEW AND EXPEDITIOUS MODE OF PREPARING HYDRARGYRUM CUM CRETA.

By Daniel Stewart, of Baltimore.

Notwithstanding the many difficulties attendant upon the preparation and use of this powder, it preserves its rank among the list of mercurials, after more than one hundred years have tested its comparative value. Indeed, it has recently been classed among three of the most valuable remedies from the long list of preparations of mercury, by one of the most learned and judicious Professors of Materia Medica in our county.* The United States Pharmacopœia, of 1840, retains it among the officinal preparations; but no improvement appears in the formula, although the tedious process indicated by it in order to accomplish the minute division of the mercury, has hitherto made us dependant on England for a large proportion of the article used in this country.

It is generally admitted that the value of this medicine is in proportion to the division of the mercury; but the Pharmacopœia gives no definite rule with regard to the tritura-

* Professor Chew, of the University of Maryland. Note, also, the frequency with which it is prescribed by Sir Charles Bell, in his Institutes of Surgery, particularly in the first part of the book; also the preference that is given to it by Dr. Gooch—Gooch's Midwifery, p. 310.

tion, and consequently the value of the product will depend on the judgment or patience of the operator. Three or four weeks' rubbing is necessary, in order to reduce it to that minute state of subdivision in which the globules will not cohere on the addition of a small portion of tinct. opii, which is frequently prescribed with it.

The cheapness of labor in England, or the use of steam power in their large chemical manufactories, has enabled them to prepare our best samples of Hyd. c. Cret. and blue mass. The foreign mercurial ointment has for some time been excluded from our market, owing to the facility with which mercury is divided, in 15 or 20 minutes, by a small quantity of lard rendered viscid by exposure to the air. It has been ascertained that other viscid substances will accomplish the same object: resinous extracts, for instance. This power, I imagine, depends not only on the separation of the minute globules, but also on the electrical condition which is excited by the friction employed, and being preserved by the resin, renders them repulsive to each other, thus facilitating their further subdivision. Upon this principle, I propose to make use of pure resin in the following formula for Hyd. cum Cret.:

℞.	Hydrargyri	℥iij.
	Resinæ	℥vj.
	Cretæ ppt.	℥v.
	Alcoholis	q. s.

Rub the mercury with the resin for three hours; add the chalk, and triturate one hour; transfer the powder to a glass jar; treat it with Oij. alcohol; pour off the solution of resin, and replace it with Oss. of alcohol; repeat the washing until the resin is removed, and dry the powder on bibulous paper; when perfectly dry, mix it intimately in a mortar. Three hours are sufficient to make a preparation in which the globules are not visible with a very powerful lens.

ART. XL.—REMARKS ON SOAP LINIMENT.

By AUGUSTINE DUHAMEL.

(Read at the Pharmaceutical Meeting of the College, May 1, 1843.)

IN accordance with the observations expressed by me at one of the late Pharmaceutical meetings, in relation to the congelation of the soap in our officinal Camphorated Tincture of Soap, when prepared with rectified alcohol, I submit with the accompanying notice, two specimens for the consideration of my colleagues, with the view to determine the most approved formula.

No. 1.—Is a specimen of soap liniment, made from castile soap and rectified alcohol in strict conformity with the directions of the U.S. Pharmacopœia of the present edition, and which is identical with that of the late edition. It is now about four months since it was made, and is filled with coagulum.

To avoid the danger that might ensue from careless digestion of the soap in alcohol, the practice more generally pursued is that of allowing time to effect a spontaneous solution of the soap.

No. 2.—Is a specimen of liquid opodeldoc, made agreeable to the following directions, and is similar to the one proposed by the Committee of Revision, when occupied with the subject of the Pharmacopœia, with but the slight difference in the proportion of water, which is here diminished. It is made in the readiest manner.

CAMPHORATED TINCTURE OF SOAP.

(Soap Liniment.)

Take of Soap, in shavings,	16 oz.
Camphor,	8 oz.
Oil of rosemary,	2 fl. oz.
Alcohol,	7½ pints.
Water,	½ pint.

Dissolve the soap in the water by heat; then mix with it the alcohol in which the camphor and oil have been previously dissolved: lastly, filter.

ART. XLI.—ON CITRATE OF IRON.

By Lawrence Turnbull.

The Citrate of Iron, an elegant preparation, has recently been introduced into this city, and prescribed by the medical faculty with much success as a tonic. As there are some precautions necessary in making this salt, and some operators having failed in their endeavors to make it, it is believed that the following notice of the process will be acceptable to the readers of the Journal.

Take of	Citric acid,	4 oz.
	Water,	4 fluid ounces.
	Moist hydrated per oxide of iron, a sufficient quantity.	

Dissolve the acid in the water, raise its temperature to about 180° Fahr., and gradually add the hydrated peroxide as fast as it is dissolved—by avoiding ebullition the oxide is taken up more rapidly, and does not lose that gelatinous consistence so important to its ready combination with acids.* When the oxide ceases to be dissolved, filter the solution, evaporate it to the consistence of a thick syrup, and spread it on plates of glass, so that when dry the laminæ

* Am. Journ. Pharm., vol. xii. page 190.

will be quite thin. The hydrated per oxide of iron should be prepared according to the formula in the U. S. Pharmacopœia, and should always be prepared for the occasion. When carefully conducted, the above process yields a salt containing about forty per cent. of the ferruginous oxide, suitable for making either powders or pills, and sparingly soluble in cold water. As it is desirable to know how much of the hydrated oxide to prepare in any operation, all that is necessary is to regulate the quantity of proto-sulphate of iron in the formula for hydrated per oxide—thus: every ounce of the proto-sulphate when peroxodized contains 147 grains of *dry* per oxide—now, as the quantity required to combine with four ounces of citric acid is 1440 grs., ten ounces of the sulphate, which will yield 1470 grains, is just about enough.

ART. XLII.—ON PHYTOLACCA DECANDRA.

By Edward Donelly.

(*An Inaugural Essay.*)

This plant, known by the name of Poke Root and Poke Weed, is found growing abundantly throughout the United States, where it is indigenous, flourishing along road sides, on the borders of fields and woods, attracting attention when in full vigor by the magnitude of its large branching stems, beset with numerous leaves, which are entire, smooth, and of an oblong shape, ribbed beneath, and supported on short foot stalks ; but the beauty of the plant is much heightened by the thickly set clusters of rich dark purple berries,

mingled, as they often are, on the same branch with the white flowers, and green unripe fruit, presenting to the eye of the observer a rich and beautiful display of color. The poke takes its name of Phytolacca from *phyton*, a plant, and *lackka*—gum-lac, from the color of its ripe fruit. It belongs to Decandria, Decagynia, Lin., Phytolacceæ, Lind.

The poke is found growing spontaneously in the northern parts of Africa, and in the south of Europe, supposed to have been introduced from America. The root as brought to the market by the herb collectors, is usually cut into transverse slices of a whitish brown color externally, wrinkled, and exhibiting, on the internal cut surface of the transverse slices, numerous concentric rings, formed by the projecting ends of fibres, between which the internal and more succulent matter has shrunk in drying.

When a new surface has been exposed, these alternate intervening circles are of a light-brown color, whilst the projecting ends of the fibres are of a yellowish white; this slight yellow tinge, observable in a new surface of the fresh dried root, is entirely lost by age, and would be a sufficiently delicate test of the quality of the article, the virtues of which are so much impaired by long keeping. Another distinguishing mark of the freshness of this root is an odor much resembling that of the "Panax quinquefolium," decidedly evident in the recently dried root, but which is entirely lost by age.

Chemical Analysis.

Not having met with any analysis of the root of this plant, the following experiments were gone into with a view of ascertaining its constituents.

Experiment First.—Four hundred grains of the dried root were coarsely powdered and digested in alcohol for several days, then thrown on a displacement filter, and successive portions of alcohol poured on, until it came away

colorless; this tincture was of a light-brown color, and appeared to contain allthe active properties of the root. Concentrated by evaporation, a fixed oil made its appearance on the surface in small globules, which were removed as fast as formed. After the oil was separated, water was added to the tincture, which caused a copious curdy precipitate, which in a few minutes floated on the surface in the flocculent form, leaving the liquid perfectly clear. This was carefully removed and evaporated to dryness in a capsule ; the dry mass was digested in alcohol until entirely dissolved, and then concentrated by evaporation. Tasted in this state it was slightly pungent and extremely nauseous. The odor somewhat resembling that of tobacco. The addition of water to a small portion gave it a milky appearance, and tested with absolute alcohol the same effect was produced; this experiment evidences properties analagous to the gum resins. On evaporating to dryness, a substance of a light-brown color was obtained, possessing the above mentioned properties in a concentrated degree; it weighed ten and a half grains. The clear liquid when concentrated by evaporation had a sweet and mucilaginous taste, accompanied by considerable astringency.

A portion tested with the acetate of the protoxide of lead, threw down a white insoluble precipitate of gum and protoxide of lead. A solution of the sesquisulphate of iron formed a bluish black precipitate, showing the presence of tannin, on which the astringency of the tincture depended. The root thus exhausted, was insipid and inodorous. When dried it weighed 362 grains, showing a loss, besides the ten and a half grains of gum resin, of twenty-one and a half grains of a mixture of gum, tannin, and a small quantity of saccharine matter, and two grains of oil, which last was subsequently found to exist in a like amount of the root. The residue was now boiled in successive portions of water, so long as the aqueous solution of iodine indicated starch; the different portions were added together and concentrated by

evaporation, which the tests showed to consist exclusively of a solution of starch. The root was again dried and weighed, indicating a loss of eighty grains, the residuum weighing 282 grains and consisting of woody fibre or lignin.

Experiment Second.—The two hundred and eighty-two grains remaining from the preceding experiment were incinerated and treated with successive portions of boiling water, until all the soluble matter was taken up. The solution filtered and concentrated by evaporation, was divided into two equal portions, one of which was tested for the soluble salts generally found in the ashes of plants, but none were detected except potassa. The other half of the liquid was evaporated to dryness and yielded six grains of carbonate of potassa, equal to about eight grains of pure potassa in the whole quantity. The residuum weighing seven and a half grains, was now treated with dilute nitric acid; the acid solution filtered, threw down, on the addition of ferrocyanide of potassium, a copious precipitate of ferrocynate of iron. The residuum remaining on the filter when dried weighed four grains, and appeared to be composed entirely of carbonaceous matter, with a minute quantity of silica, showing that the acid had taken up three and a half grains, which the tests proved to be iron.

Experiment Third.—Four hundred grains of the root in coarse powder were digested in sulph. ether for several days, then thrown on a displacement filter and returned several times. Successive portions of ether were then added until it came away colorless. The etherial solution thus obtained had a light straw color. Upon evaporation, it yielded a dark-brown colored oil weighing two grains. This oil is sparingly soluble in alcohol, it combines readily with the alkalies, forming soaps; leaves a greasy stain on paper, and seems to possess all the properties of a fixed oil.

From these experiments it appears that the root of the *Phytolacca decandra* is composed of the following con stituents:

Woody fibre, or lignin,	66.5
Starch,	20.
Tannin, gum, and saccharine matter,	5.375
Gum-resin,	2.625
Potassa,	2.
Iron,	.875
Fixed oil,	.5
Silica and carbonaceous matter,	1.
Loss,	1.125
	100.

Medical Properties.

The medical properties of this plant reside in the leaves, berries and root; the two latter are *officinal.* As the active principle abounds most in the root, it is on that account more generally used, and is the only part of the plant kept in the shops. A tincture made of the berries is a favorite remedy of the country people, in some sections, for the cure of rheumatism. Thompson in his Organic Chemistry, says, "The berries of this plant give a beautiful purple color to water of a very positive nature. A few drops of lime water changes it to a yellow, and this yellow liquid is the most delicate test of acids hitherto observed. The smallest quantity of acid restores its purple color. Bracconot, to whom we are indebted for these observations, has shown that it is at least four times as delicate as the infusion of litmus. Unfortunately it alters its nature in a few hours, and then loses its delicacy as a reagent. It can only be used when recently prepared." A tincture of the berries is officinal. Poke root, though seldom prescribed by physicians, is an exceedingly active remedy, operating at once as an emetic, purgative, and narcotic. In very large doses it is said to produce excessive and long continued vomiting, accompanied with purging and symptoms of acro-narcosis. I have known it to produce all the effects of a heavy cold on a person powdering it, accompanied with headache, purging

and much prostration of strength. An ointment, made both from the leaves and powdered root, has been used in the treatment of cutaneous diseases; and an extract, prepared by evaporating the expressed juice of the leaves, had a reputation at one time, as a remedy in the cure of cancer.

REVIEWS.

ART. XLIII.—THE DISPENSATORY OF THE UNITED STATES OF AMERICA. By George B. Wood, M. D., Professor of Materia Medica in the University of Pennsylvania, &c., and Franklin Bache, M. D., Professor of Chemistry in Jefferson Medical College of Philadelphia, &c. Fifth edition, enlarged and carefully revised. 1 vol. 8vo., pp. 1368. Grigg & Elliot, 1843.

During the ten years that have elapsed since the first edition of this work, the exceeding high estimation in which it is held by the medical and pharmaceutical public, has been evinced by the constant demand for it, and the rapid disposal it has met with.

Previous to its appearance, the state of pharmacological knowledge in this country was so impoverished and barren, in consequence of the paucity and meagreness of systematic treatises, which were far behind the age, not only with respect to scientific details, but really important practical discoveries, that, at the time of its publication, the *United States Dispensatory* might almost be regarded in the light of a revelation, and, in conjunction with the valuable auxiliaries, periodical, and others which have since been associated with it, it has contributed to dispel the ignorance, apathy, and indifference that depressed one of the most extensive

and necessary departments of medical science. To institute, however, a comparison between the condition of American pharmacology during two distinctly marked eras that have been under our immediate observation, would be an extended occupation; we wish only to refer to such epochs connected with its history, in noticing a work which is inseparable from the agencies that gave rise to reformation, and which has largely conduced to awaken a taste for the cultivation of the materia medica, and to demonstrate its capabilities. The indefatigable authors have labored assiduously in the field to which they have devoted themselves; and it will be admitted, that it is no disparagement to other meritorious individuals to assert, that they have done more than a mere share to render fertile the waste and unproductive places.

In each succeeding edition of the Dispensatory, the work has been rendered a full compendium of the existing information; improvements and alterations have been introduced, and a jealous vigilance has been exercised with respect to additions and discoveries in science at home and abroad; but it is stated in the preface to this, the fifth edition, that "on no revision have the authors bestowed so much labor as on the present," and the following reasons have been given: The new editions of the United States and Edinburgh Pharmacopœias required comment; and the recent pharmocological treatises of Dr. Pereira and Dr. Christison, containing much original observation, and the Medical Flora of Dr. Lindley, not to speak of other valuable works in different departments of materia medica and pharmacy, afforded a great mass of new materials for selection and arrangement. The periodical press has also presented much that demanded notice, and the changes in the commerce in drugs, and the various modifications in pharmaceutical operations, resulting from increased experience and the advancement of science, called for careful personal examination and inquiry. It appears that the materials have so far increased, that even "by

pruning redundances and concentrating the new matter within the smallest possible space, the authors have been compelled to exceed the former limits by more than one hundred pages."

The method and arrangement of the United States Dispensatory are too familiar to require *their being detailed;* the same divisions have been introduced into this as in former revisions. The changes that have been made consist of new information with regard to the articles of the materia medica, with additional accounts of medicinal substances; the improvements which preparations have undergone in their modes of formation; an exposition of such as have been recently introduced; and, lastly, the improvements in pharmaceutical processes.

It would be impossible, except in an elaborate analysis, to present all the particulars in which alteration is apparent, as this would occupy more space than we can allot to them. We shall, therefore, have to restrict our attention to such as are most striking and important. To facilitate our endeavor, we shall present the articles of the materia medica as they are afforded by the three kingdoms of Nature, taking up first those of the *vegetable.*

Aloe.—Upon the authority of Lindley's *Flora Medica,* it is stated that the *A. purpurascens, A. arborescens, A. commelyni,* and *A. multiformis,* all natives of the Cape of Good Hope, yield the product in addition to the species to which it has hitherto been referred. The three species that are particularly described are, the *A. spicata,* the one assumed as officinal by the U. S. and London Pharmacopœias, the *A. socotrina,* and *A. vulgaris.* The Cape aloes is "collected by the Hottentots and Dutch boors, indiscriminately from the A. spicata and other species which grow wild in great abundance. The process is very simple. According to the account of Hallbeck, a Moravian missionary, who resided at the Cape, a hole is made in the ground, in which a sheep skin is spread with the smooth side in-

ward. The leaves are then cut off near to the stem, and arranged around the hole, so that the juice which runs out may be received into the skin. The juice flows most freely in hot weather. (Un. Breth. Mission Intelligencer, N. Y., vol. vi. p. 436.)" "The finest kind is collected at the Missionary Institution at Bethelsdorp, and hence called *Bethelsdorp aloes.* Its superiority is owing exclusively to the greater care observed in conducting the evaporation, and in avoiding the intermixture of earth, stones, and other impurities. (Dunsterville, in Pereira's Mat. Med.)"

In the case of socotrine aloes, it is stated, that "we have been able to discover no good reason for depriving the *A. socotrina* of the honor formerly conceded to it, of producing this variety of aloes. If the species under this name, which is described in *Lamark's Encyc.*, and in *Curtis' Mag.*, where it is also figured, as well as in the *Plantes Grasses* of Decandolle, be the product of Socotora, it must be conceded to be the true plant, Ainslie's authority to the contrary notwithstanding." This kind has been brought direct to this country. By the ship *Sultanee,* from Muscat, despatched by the Imaum, several qualities of the drug were introduced—the finest corresponding to the description given in the work; the coarsest, dark-colored, dull, dirty, and, when dry, very friable, answering to the account of hepatic aloes. This circumstance favors the opinion, that the East Indian hepatic and socotrine are derived from the same source.

Catechu.—No difficulty in correctly attributing the varieties of drugs to their correct sources has been greater than that connected with the determination of astringent substances. Of this, catechu may be cited as an example. Beside *Acacia catechu,* several other plants are now described as yielding different kinds of it. The varieties are presented in the Dispensatory as officinal and non-officinal. To the first belong—1. *Plano-convex catechu, (Cake catechu,)* of which it is said, that "it is common at present in

our market, but we have been unable to trace its origin accurately. There can be little doubt, from its internal character, that it comes from the East Indies, and is the product of *A. catechu;* but no accounts that we have seen, of the preparation of the drug in particular geographical sites, indicate this particular shape; and it is not impossible that portions of it may be formed out of other varieties of catechu by a new solution and evaporation." 2. *Pegu catechu.* This is stated to be derived from Burmah. "It enters commerce, probably, in general, through Calcutta, in large masses, sometimes of a hundred weight, consisting of layers of flat cakes, each wrapped in leaves, said to be those of the *Nauclea Brunonis.* In this form, however, we do not see it in the shops; but almost always in angular, irregular fragments, in which portions of two layers sometimes cohere, with leaves between them, indicating their origin. It is characterized by its compactness, its shining fracture, and its blackish-brown, or dark, Port wine color, so that when finely broken, it bears no inconsiderable resemblance to kino." 3. *Catechu in quadrangular cakes.*—We are told that "this is scarcely ever found in the shops in its complete form, and the fragments are often such that it would be impossible to infer from them the original shape of the cake. This is usually between two and three inches in length and breadth, and somewhat less in thickness; of a rusty brown color externally, and dark brown, or brownish-gray, within, with a somewhat rough and dull fracture, but when broken across the layers in which it is sometimes disposed, exhibiting a smoother and more shining surface." "There is little doubt that this variety comes from the provinces of Bahar and Northern India, where the preparation of the drug was witnessed by Mr. Kerr and Dr. Boyle, who both speak of it as being cut, when drying, into the quadrangular form. It has been called *Bengal catechu,* because exported from that province." 4. *Catechu in Balls.*—This occurs in two forms: "the one consisting of globular balls, about as large

as an orange, very hard and heavy; of a ferruginous aspect externally; very rough when broken, and so full of sand as to be gritty under the teeth; the other in cakes, originally, in all probability, globular, and of about the same dimensions, but flattened, and otherwise pressed out of shape before being perfectly dried; sometimes adhering two together, as happens with the lumps of Smyrna opium, and closely resembling, in external and internal color, and in the character of their fracture, the quadrangular variety." "The former kind is rare, and the specimens we have seen had been twenty years in the shop, and had very much the appearance of a factitious product. The latter is, in all probability, the kind known as Bombay catechu, as Dr. Hamilton, and, more recently, Major Mackintosh, in describing the mode of preparing catechu on the Malabar coast, of which Bombay is the entrepôt, say, that while the extract is soft, it is shaped into balls about the size of an orange."

To the second class, viz., *non-officinal*, belong, 1, *Gambir, Terra Japonica.* The plant which affords this product is the *Uncaria gambir* of Roxburgh and Decandolle, formerly known as *Nauclea gambir.* Formerly, the East Indian kino was attributed to this plant, which has now been corrected, and the substance which it yields placed among the varieties of catechu. A peculiar white proximate principle found in it is called *catechuin,* or catechuic acid. 2. *Areca catechu.*

Cinchona.—The botanical account of this valuable drug is somewhat altered from that of the last edition. This has been done in consequence of the information presented by Prof. Lindley, from close investigation of the materials for comparison and study. The author of the article on this subject years since distinguished himself by laborious devotion to it, and the learned essays resulting from his inquiries constituted a repository from which even skilful pharmacologists could obtain valuable truths. Well able, then, has he been to appreciate the additions of another. For the de-

scription of the species, however, we must refer to the book. We notice that greater precision has been adopted in describing the varieties of bark, and, under the head of Carthagena, these are presented in detail. Such as are denominated *false* are likewise more particularly specified. The whole subject of Quinology contained in the work is worthy of attentive perusal.

Kino.—As assumed by the U. S. Pharmacopœia, this is stated to be "An extract obtained from an uncertain plant," although under the head of each variety the source is discussed. The *East India*, or *Amboyna Kino*, was for a time supposed to be the product of the *Nauclea gambir*, now the *Uncaria gambir*. This, however, has been determined to yield a variety of catechu, (see remarks on this subject.) The origin of the drug is not known precisely, as we are informed by the following quotation: "The name of Amboyna kino would seem to imply that it comes in part, at least, from that island. But Pereira states, that all the importations he could trace were from Bombay and Tillicherry, and he therefore conjectures that it is collected on the Malabar coast. Roxburgh suggests that it may be derived from the *Pterocarpus marsupium*, an East Indian tree, the juice of which is strongly and simply astringent, and hardens into a dark, very red, brittle mass, which assumes a lighter color when powdered. (Lindley's Flor. Med., p. 256.)"

West India, or Jamaica kino, which is believed to be the product of the *Coccaloba uvifera*, is brought into the market in gourds. From a specimen, which came into the market as authentic, it is thus described: "When taken from the gourd, it breaks into fragments of various sizes, upon an average about as large as a hazel nut, and having some tendency to the rectangular form. The consistence of these fragments is uniform; their surface smooth and shining, and their color a dark reddish-brown, approaching to black. They are, however, not so glistening, nor so

black, as the East India kino. In mass they are quite opaque, but in their splinters are translucent, and of a ruby redness. They are readily broken by the fingers into smaller fragments, are easily pulverized, and yield a dull reddish powder, considerably lighter colored than that of the former variety. The West India kino is without odor, and has a very astringent, bitterish taste, with a scarcely observable sweetish after-taste. It adheres to the teeth when chewed, though rather less than the East India variety, and colors the saliva red." An article named *South American*, or *Caracas kino*, is described; it has a close resemblance to the preceding, and is common in our market. We coincide in opinion with the authors, that it is a variety of the West India, derived from a like source, but a rougher article. The *African* and *Botany Bay kino* are described as they are noticed by European authorities; it appears that no new light has been thrown upon them. To determine, accurately, the natural history of the different species of this drug, would be a labor of great interest to science.

Prunus Virginiana.—Our readers may not be aware that this name is now used merely in a pharmaceutic sense, indicating the *Wild Cherry Bark*, and does not apply to the plant from which it is obtained. It appears that *Prunus Virginiana* was the designation given by Linnæus to the *Choke Cherry*, but was supposed by Michaux to mean the *Wild Cherry*, from whom originated a mistake which has subsequently been perpetuated. He changed the generic name, under this impression, from Prunus to Cerasus, and called, as he supposed correctly, the *Wild Cherry*, *Cerasus Virginiana*, and the *Choke Cherry*, *Cerasus serotina*. Decandolle has pointed out this error, and reversed the employment of the terms, so that the anomaly in pharmaceutic nomenclature now presents itself, of calling a drug by a synonyme of one plant, while, in the same line, almost, it is stated to be procured from another. This will have ultiamtely to be changed, as the only difficulty to be overcome

is habit. For the botanical account of the species, the Flora of North America may be consulted.

Sarsaparilla.—In addition to the three species described in the last edition, a fourth is at present noticed, called *Smilax medica*. The old species, *S. sarsaparilla*, is our own plant, and as it is known, at least by American pharmacologists, not to afford the drug, it ought to be given up. The *Brazillian*, or, as it is called, *Para sarsaparilla*, is more particularly described. It, of late, has come into our markets, and is less scarce than formerly.

Senna.—We do not perceive that any new information has been presented with respect to the plants affording this drug. Several years ago, we advocated the idea, in this Journal, that the *Cassia lanceolata* of Forskal and Nectoux, and *C. acutifola* of Delile, were varieties of the same plant. Independent of other considerations, which were presented at length, our faith in the opinion was supported by the views of Decandolle. Lindley, however, regards them now as distinct. The Tripoli senna is referred to the *C. Æthe-opica* of Guibourt, which is the same as *C. ovata* of Merat.

We shall here close our remarks upon the vegetable products. With respect to animal substances, we perceive no alterations worthy of record. The additions that have been made to the articles of inorganic origin, are such as the advance in chemical discovery rendered necessary.

Acidum arseniosum.—The subject of the antidote to this virulent poison is more elaborately and precisely treated of than it was in the last edition. The rationale of its operation is thus given: "The antidote acts by producing with the poison, by a transfer of oxygen from the oxide to the acid, an insoluble, and therefore inert, sub-arseniate of protoxide of iron, ($4FeO+As_2O_5$)." Under this head, the full importance of our able collaborator, Mr. W. Procter's, experiments has been set forth.

Ammoniæ murias.—The description of the process for preparing this compound is changed, and that pursued by

the English chemical manufacturers presented. In this is exhibited the advantage and facility of applying the useless products of one manufactory to the purposes of another; the materials from which it is fabricated being *gas liquor* and *bone spirit*—the first afforded by gas works, the latter by ivory-black establishments.

Magnesiæ carbonas.—"Two kinds of Carbonate of Magnesia are distinguished; the light and the heavy. The light carbonate is the kind manufactured in Scotland. The heavy, according to Dr. Pereira, may be manufactured as follows: Add one volume of a cold saturated solution of carbonate of soda to a boiling mixture of one volume of a saturated solution of sulphate of magnesia, and three volumes of water. Boil until effervescence has ceased, constantly stirring with a spatula. Then dilute with boiling water; set aside; pour off the supernatent liquor, and wash the precipitate with hot water on a linen cloth; afterwards dry it by heat in an iron pot."

In the part devoted to preparations, which constitutes the second portion of the work, much new matter has been introduced, and such alterations made as have been rendered necessary by the advance in our pharmaceutic knowledge.

Under the head of Acetic Acid, is given a more detailed account of the mode of production and comparative strength of the different officinal products; and the specific gravities are presented in a tabular form. *Hydrocyanic acid, Oil of wine, Nitrous ether, Sweet spirit of nitre,* as well as many others, are more satisfactorily treated of. Several new medicines have been introduced into the appendix, as belonging to the non-officinal list. The article upon displacement has been extended, and such specifications made of the method as to render it available in pharmaceutic operations. We must forbear, however, from entering into further particulars, and terminate a notice which has extended much beyond the limits contemplated when it was commenced. If the good that has been effected by the United Stated Dis-

pensatory is an earnest of the future beneficial influence it will exert, we cordially welcome its reappearance, and doubt not that its success will fully equal its exalted merits. J. C.

ART. XLIV. — CHEMISTRY, IN ITS APPLICATION TO AGRICULTURE AND PHYSIOLOGY. By JUSTUS LIEBIG, M.D., &c., Professor of Chemistry in the University of Giessen, &c., and ANIMAL CHEMISTRY, OR ORGANIC CHEMISTRY, IN ITS APPLICATION TO PHYSIOLOGY AND PATHOLOGY. By JUSTUS LIEBIG, M. D., &c., Professor of Chemistry in the University of Giessen, &c. 8vo. James Campbell & Co. 1843.

ALTHOUGH it is within but a few years that the department of Organic Chemistry has commenced to acquire importance, so rapid has been its progress, that, at the present time, it enrols on the list] of its devoted cultivators names of many eminent for talent and industry. Among these the author of the above treatises stands pre-eminent. Appointed by the chemical section of the British Association for the advancement of Science, to report on the state of Organic Chemistry and its applications, he has undertaken to fulfil the task in three parts, two of which are now before us. We will endeavor to place before our readers a condensed abstract of the views contained in these reports, but for most of the details we must refer to the works themselves.

The ultimate constituents of organized bodies are carbon, hydrogen, oxygen, and nitrogen, together with a few other elements not so essential to their formation. Agreeing in ultimate constitution, animal and vegetable structure, however, differ essentially as to their source of nutrition, and the forces by which this process is sustained. In both there is recognized a force whose natural state is rest, but which,

by external influences, is disturbed, and, as a consequence of motion thus effected, produces structural form. To this the name of *vital force*, or *vitality*, is applied. The influences, however, by which this force is disturbed, and the instruments by which it acts, are very different. Vegetables require for their nourishment matters reduced to their inorganic state as the result of decomposition ; but animals can only derive nourishment from highly organised particles. In the former the state of rest is disturbed by the influences of air, moisture, and light, while to the mere vegetative life there is superadded, in the latter, faculties of sensation and motion, acting through a nervous organism. These wide differences require a separate consideration.

For the growth and reproduction of vegetable structure, the elements which constitute that structure must be present in the source of nourishment. To the soil upon which they rest is the most natural source to which to look for this supply; and great importance has been attached to their composition. To the matter recognized as the source of fertility the name *humus* has been applied, and the opinion advanced that this substance is extracted by the roots of plants, and serves to the production of their tissues. This opinion the author considers as untenable. Humus does not appear capable of solution and consequent absorption by plants, unless previously acted on by alkalies, and converted into the so-called humic acid; and even under the most favorable circumstances, the amount of alkali, even with the oxides of iron and manganese in the soil, is not by any means sufficient to render soluble in the form of humic acid the quantity of carbon which exists in the vegetable structure in any given space. This is shown by an estimation of the amount of carbon annually produced on one acre of woodland in comparison with the metallic oxides present, these latter being capable of conveying sufficient carbon to form only 100 pounds of dry wood—but one-thirtieth of the actual amount produced. Carbon may also be conveyed away

under the form of vegetable structure from the surface of any given soil, and yet the quantity of humus so far from decreasing, has increased in amount. This position is sustained by a series of arguments and calculations confirmatory of this fact. Humus, moreover, is not necessary to some plants, which will live and flourish separate from any soil; aud there must have existed a period in the first formation of all soils, when no humus could have been present, this susbtance being the result of decay of previously existing vegetable structure. Whence, then, is the source of this element? The only other source is the atmosphere. An examination of the air results in the determination that, besides its main constituents, it contains a small but invariable amount (1-1000 part of its bulk) of carbonic acid. Small as is this proportion to the whole amount, yet by "calculation it can be shown that the atmosphere contains 3306 billion pounds of carbon;" "more than adequate to all the purposes for which it is required." Carbonic acid, existing in the atmosphere to this amount, is always in contact with the leaves of the plants, and, from its solubility, is carried down and conveyed to their roots by the rain. By experiment, it has] been determined that when living vegetables, surrounded by an atmosphere of carbonic acid, or immersed in a solution of this gas, are placed under the influence of the sun's light, either direct or diffused, the carbonic acid disappears, and is replaced by pure oxygen; but, in the absence of light, this effect ceases, and, on the contrary, carbonic acid is given out. This latter fact has been adduced as disproving the decomposition of carbonic acid. To understand properly this difference of result, it is necessary to separate the vital action from a decomposition of a purely chemical nature. It is only when the static force of vitality is affected by the external influence of light, that this action is produced; but place the plant under other circumstances, in which the action is merely chemical, and the result is very different. If a dead or living plant be sub-

jected to the action of oxygen in the dark, then the chemical affinity of the inorganic elements are brought into action, —leaves change their color, oils become resins, and various other changes take place, such as usually result from the chemical action of oxygen. The oxygen disappears during night, from entering into combination with portions of the organized structure, and the carbonic acid thrown off is that which has been absorbed by the unceasing action of the roots, and not being subjected to the proper influence, can not be assimilated by the plant.

Experiments have been instituted to prove that carbonic acid is not sufficient for the nourishment and perfection of vegetable structure. But the only conclusion to be derived from them is, that other substances are also essential to this result, or that perfection of vegetable structure cannot be obtained without all the elements which are necessary to its composition,—grass cannot be formed without silex,—grain without phosphate of magnesia, &c.

Although the carbon of the vegetable structure is derived from carbonic acid of the atmosphere, yet humus still acts an important part in the vegetable economy. This substance is not a constant and definite compound, but, on the contrary, is matter in a state of transition. "Woody fibre in the state of decay is called *humus*." All woody fibre when exposed to the action of oxygen yields carbon, which undergoes a very slow combustion, and carbonic acid is produced. To effect this, moisture is necessary, and alkalies accelerate it, while acids produce a contrary effect. The carbonic acid in solution is absorbed by the roots, and this supply, though small, is most essential at that period in the year when the plants are destitute of those organs (leaves) which are capable of drawing their nourishment from the atmosphere.—Also, the young plant, before it protrudes from the ground, is surrounded by it, and also derives its support partly from this source, before its organs have arrived at maturity. The effect of culture is to hasten the slow combustion of the

woody fibre, by allowing a more free access of oxygen of the air.

Hydrogen and oxygen also enter into the composition of vegetables. Pure woody fibre contains these elements in the proportion to form water; but other parts may contain one of these elements in a greater or lesser proportion. The source of these elements is obviously supplied by the decomposition of water, and a greater or lesser amount of each element is assimilated according to the compound formed.

Nitrogen exists in many vegetable compounds, and the source of its supply is an important point. Plants will grow in pure charcoal if moistened with rain water; rain water can only contain nitrogen as dissolved atmospheric air, or in the form of ammonia, but nitrogen, when uncombined, is a remarkably indifferent substance, while its combinations are capable of ready transformation. Experiments have placed beyond doubt the existence of ammonia in the atmospheric air; for it has been detected in rain water and in snow. The sources from which it is derived are fully pointed out, but our space will not admit of detail, and the inferences drawn from this important discovery can only be properly appreciated by a perusal of the author's remarks.

These four elements constitute the principal amount of vegetable matter, but other substances are equally necessary in the formation of special organs; viz., their inorganic constituents. These have been supposed to be only accidentally present, being taken up by the plants because existing in the soil, and that they exercise no peculiar influence on the growth. Analyses of the ashes of the same kind of vegetable productions, grown on different soil, in which unequal amounts of the metallic bases were obtained, are adduced in proof of this. But "it must be considered as a most remarkable accident, that these same analyses furnish proof for the very opposite opinion." These bases exist in the form of salts, and when the amount of the different metallic oxides

present are compared, not by actual weight, but by the relative or proportional weight and saturating power, it results that the amount of acids necessary to saturate the bases would be the same in all. When one metallic oxide is deficient, its place is supplied by another; not in the same actual weight, but in the precise amount indicated by its chemical equivalent. The quantity of acid present, and which is generally organic, would seem to regulate the supply of the inorganic base; but the extent to which this substitution of one base for another may take place, has not been sufficiently ascertained. It is only known that, in some cases, lime or magnesia may, to a certain extent, replace potassa; and that some of these may be replaced by an organic base: while, on the other hand, the organic acid may occasionally be replaced by an inorganic acid. Certain bases are, however, known to be indispensable, as potassa to vines; and in every instance where any essential organ contains an invariable saline constituent, either that or its elements must be supplied. These views are supported by example and argument confirmatory of the position.

We must pass over the chapters on the Art of Culture and Rotation of Crops with very few remarks. All the soil on the earth's surface was derived, originally, from the disintegration of rocks. In their solid or unbroken state they yield very slowly any of their constituents to the action of acids, but the slow and continued action of carbonic acid and moisture, on those containing alkalies, gradually decomposes them, and dissolves the alkaline carbonate. By these agencies, and the action of change of temperature, disintegration takes place, and the soil is formed capable of yielding its constituents to plants. The soluble matter will gradually be abstracted, and the soil becoming exhausted, temporary sterility will be produced. As the disintegration goes on, the soil regains its fertility. In this lies the secret of the success attending the cultivation of a succession of different cropson the same soil. A crop which abstracts potassa largely

from the soil, will soon cease to flourish when the supply becomes deficient, and another crop, requiring less or none of this element, will flourish on the same soil. If the field be allowed to produce weeds, which will return to the soil, by decay, all that they have taken up, or if plants are produced which do not abstract the alkalies, then the result of the slow disintegration of the soil again produces fertility by rendering the alkalies soluble. In connection with this point, it is to be considered that experiments have positively proven that roots expel those matters which the plant is not capable of assimilating, and the accumulation of these secretions ultimately proves injurious to the kind by which they have been secreted. These excrements, by gradual decomposition, become converted into humus, and cease to be hurtful, and even before decomposition may not be deleterious to plants of a different nature.

Very important observations follow on the character, formation, and operation of manures, and their peculiar value, together with extensive analyses of soil from different parts, for which we must refer to the work itself, and pass to the consideration of the second part, or the Application of Organic Chemistry to Physiology and Pathology.

"In order to keep up the phenomena of life in animals, certain matters are required—parts of organisms, which we call nourishment. In consequence of a series of alterations, they serve either for the increase of the mass *(nutrition,)* or the supply of the matter consumed *(reproduction,)* or, finally, for the production of force."

The author considers that the state of rest is determined by the force of chemical affinity operating to effect combination, and the subsequent motion, the result of a series of changes produced by the decomposition of the food itself, or the organs formed from it. In support of this opinion, the continued action of the oxygen of the atmospheric air first attracts his attention. The amount of this element, which is abstracted from the air by the lungs of a healthy

adult, is estimated by different authors at from 746 to 837 pounds in a year; yet the increase, or variation of weight, in an individual amounts only to a few pounds. What, then, has become of this large amount of matter? An examination of the products given out from the body during the same period, affords a satisfactory elucidation of this question. Carbonic acid and water, both requiring oxygen for their formation, are constantly separated from the system, and in amounts proportionate to the oxygen which disappears. For, "if we assume, with Lavoisier and Seuguin, in order to obtain a foundation for our calculation, that an adult man receives into his system, daily, 32.5 oz. of oxygen, and that the weight of the whole mass of his blood, of which 80 per cent. is water, is 24 lbs.: it then appears, from the known composition of the blood, that, in order to convert the whole of its carbon and hydrogen into carbonic acid and water, 64.103 grs. of oxygen will be required. This quantity will be taken into the system of an adult in four days and five hours."

It has been determined, by observation, that an adult consumes the average daily amount of 13.9 oz. of carbon, after deducting from the whole amount of ingesta that portion which passes off as the refuse of the system, and in the form of secretions unaffected by the absorbed oxygen. The whole of this must escape from the lungs as carbonic acid, requiring, to effect this, 37. oz. of oxygen. The oxygen taken into the system is found in no other form or combination than with carbon or hydrogen; and, as the carbon and hydrogen carried off is replaced by the same elements from the food, a direct ratio is immediately established between the amount of oxygen respired and the food consumed. This is illustrated by the fact, that those circumstances, either natural or artificial, which cause a variation in the number of respirations, also produce a difference in the amount of ingesta necessary for the support of the vital action, of which

several examples are adduced, derived from youth and age, labor and rest, and difference of climate.

As one of the incidental results of the combination of carbon and hydrogen, the temperature of body, or animal heat, is to be considered. Here it is to be noticed, that those parts, only, which are supplied with arterial blood (or that which has absorbed oxygen) possess a temperature superior to the surrounding medium. As we find out of the body, that carbon cannot unite with oxygen without producing an elevation of temperature, and that from a definite weight, the amount of caloric is the same, whatever may be the time consumed in the effecting the combination, so the same cause in the body must produce similar results: and thus, in the slow combustion of the carbon and hydrogen of the food, or of the organism, we have the source of animal heat. If this be the fact, then those circumstances which influence the consumption of oxygen, will also influence the animal temperature, and this is found to agree with observation. Animals of quick respiration, and who require a large amount of oxygen, belong to the class of warm blooded animals, and possess an elevated temperature; while those which require but little oxygen, (as fish, which only obtain it from the air contained in water,) possess a temperature but little above the medium in which they live.

In man, the temperature of the adult is uniform in every region of the globe. How does this correspond with the amount of oxygen respired, and of carbon received by the system? In the warmer regions of the globe, the natural instinct leads to food deficient in carbon, and the atmosphere expanded by heat, does not afford as large a supply of oxygen; while, in the colder, the contrary is exhibited, and that food is preferred which affords a large proportion of carbon, and the increased density of the atmosphere at the same time supplies more oxygen for its combustion—with the consequent elimination of a greater abundance of caloric to supply that abstracted by the lower temperature of the

surrounding air. The habits and manners of different nations also afford proof to the same effect. In civilized nations the loss of heat is prevented by the use of clothing, not allowing ready escape for caloric, but in many barbarous nations no such protection is used, and this with the active exertions of hunting, requiring a greater amount of caloric, they are able and do consume a proportionally greater amount of food, and that also of an animal nature. In starvation, and in hybernating animals, the organs themselves supply the matter to be consumed, and which is not replaced by the nutritive process. All the oxygen which enters the system daily, is given out again in combination with part of the body; and death results with greater or less rapidity, in proportion to the bulk of the individual, the exertion used, and the temperature of the surrounding medium.

These observations lead to very important and interesting views, as to the operation of external agents in health and disease, of which our space will not permit the notice.

In the nutritive process, it must be conceded, that the blood is the all-important agent in supplying the means of increase, development, and waste. It is, then, to the composition and ingredients of this fluid that we must look to determine what substances are nutritious, or capable of conversion into blood.

The most important ingredients of this fluid are *albumen* and *fibrine*. Chemical analysis of these bodies leads to the remarkable fact, that they are identical in composition; containing, notwithstanding their dissimilar physical properties, the same elements, and in the same proportion. They also agree in some of their chemical reactions, and fibrine has even been converted into albumen by chemical agents. From this identity, there is no difficulty in conceiving the conversion of blood into muscular fibre, and muscular fibre into blood. All the other parts of the animal structure contain the same elements which are to be found in blood. They all contain

17 per cent., at least, of nitrogen, together with carbon, hydrogen, and oxygen; and in some are found, more especially, the inorganic elements contained likewise in blood, iron, lime, phosphorus, magnesia, &c.

Such being the composition of the blood, and its ready formation from organized animal structure, this structure will then afford the materials most readily assimilated, and, in carniverous animals, the function of digestion will be exhibited in the most simple form. Organized structure, derived originally from blood, becomes dissolved in the stomach, and, in the course of its transmission through the system, becomes again blood, to be again transformed into organized structure.

But, in gramnivorous animals, this process is not so evident. Food, apparently very distinct in its character, is here assimilated and undergoes the same changes. Chemical research explains with satisfaction this result. Vegetable matter is found to contain the same ultimate elements as animal organism, and, what is much more remarkable, combined to form certain proximate ingredients, which not only possess similar chemical characters with albumen and fibrine, but, by analysis, are proved to be identical in composition. These nitrogenized constituents of vegetable food are, vegetable albumen, fibrine, and casein. They are identical in properties with the chief constituents of blood, and the identity among all extends to their ultimate composition, so that no difference in their elementary formation can be observed. This similarity in composition can even be traced to a still greater extent. According to the observations of Mulder, all these nitrogenized compounds, whether vegetable or animal, yield, under the action of a solution of caustic potassa and heat, a solution from which acetic acid precipitates a gelatinous substance, (proteine,) in all cases identical. In ultimate composition, proteine differs from all the tissues by containing an additional amount of oxygen and hydrogen, to which, also, in some degree, phosphorus, sulphur, and ni-

trogen are superadded; or, in other words, proteine only requires the addition of these elements to constitute any elementary tissue.

"How beautiful and admirably simple, (exclaims the author,) with the aid of these discoveries, appears the process of nutrition in animals, the formation of their organs, in which vitality resides!"

These substances all contain nitrogen; but other substances, which do not contain this element, appear essential to the well-being of a certain class of animals; these are, sugar, starch, gum, &c. These three substances are nearly similar; all consisting of the same amount of carbon, united with different amounts of hydrogen and oxygen, with proportions to form water.

The author considers that it is the carbon alone which here acts an efficient part in the animal economy, and that it is destined to supply, in gramnivorous animals, that element essential to the production of heat, and which would otherwise be insufficient, as the amount of carbon taken in with the food would be incapable of producing, with the oxygen, the quantity of carbonic acid which is thrown off, in addition to that which is present in the secretions. These views are supported by a well-chosen series of arguments, in which the process of conversion is traced in all its details.

It is to the substances destitute of nitrogen that our author looks for the formation of fat,—a substance in the animal structure destitute of nitrogen, and without traces of organization. These substances being required to supply carbon, which, by its combination with oxygen, forms the expired carbonic acid, let us look to the result of continuing their supply, and diminishing its necessity. An illustration is drawn from the stall-fed animal: it eats, and reposes merely for digestion. Without exercise, and protected from cold it absorbs less oxygen, and, consequently, less carbonic acid is produced. The excess of carbon must be appropriated to

some other purpose, and this other is the formation of fat. This is evinced in the feeding of animals on substances containing nitrogen. They do not become fat, although their bulk is increased by the expansion of the organic tissues; whereas, in corn-fed animals, the nitrogen being deficient, the fat is formed in excess. An examination of the composition of fatty bodies will show how this may take place. Gum, sugar, &c., and fats, differ in composition, principally in regard to the amount of oxygen; the carbon and hydrogen being in nearly the same ratio in all. This being the case, to convert starch, &c., into fat it is only necessary to abstract oxygen, together with a small amount of carbon. Here, then, the deficiency in absorption of atmospheric oxygen, gives rise to the abstraction of oxygen from the food, and the subsequent conversion of the food, or of the organism itself, into principles deficient in that element.

It follows, from these views, that the food of man "may be divided into two classes: into *nitrogenized* and *non-nitrogenized.*" "The former may be called the *plastic elements of nutrition;* the latter, *elements of respiration.*" Among the former, are vegetable albumen, fibrine, and caseine, with animal flesh and blood. Among the latter, fat, starch, gum, sugar, pectin, bassorin, alcoholic and fermented liquors.

The remainder of the work is devoted to an examination of the chemical processes engaged in the production of the secretions, bile, urine, &c., and the nervous organism, accompanied by copious analyses and calculations; and in speculations on the laws of the phenomena of motion, together with the theory of disease and respiration. These we are compelled to pass over; and, in concluding would remark, that the terse and sententious nature of the author's style, creates an appearance of obscurity, requiring very close attention, in some parts, to ascertain the true meaning.

R. B.

ART. XLV.—ELEMENTS OF CHEMISTRY, INCLUDING THE APPLICATIONS OF THE SCIENCE IN THE ARTS. With Numerous Illustrations. By THOMAS GRAHAM, F. R. S., Lond. and Ed. Professor of Chemistry in University College, London, &c. With Notes and Additions, by ROBERT BRIDGES, M. D., Professor of General and Pharmaceutic Chemistry in the Philadelphia College of Pharmacy, &c. Philadelphia: Lea & Blanchard. 1843.

THE student of Chemistry, in this country, cannot but be gratified by the issue of an American edition of Graham's Elements by its enterprising publishers, which places at his disposal another excellent exposition of chemical science, and one which is at least equal to any other work on the same subject in the English language.

Part first contains the fundamental doctrines of the science, and embraces, "under the heads of Combining Proportions, Atomic Theory, Doctrine of Volumes, Isomorphism, Isomerism, Constitution of Salts and Chemical Affinity," a mass of valuable information. The author's views of classification, which have been adopted by Kane, are also stated at length in this part of the work.

Part second contains a description of the non-metallic and metallic elements, together with their binary compounds and salts. This portion of the work, while it is amply comprehensive in detail for the purposes of a text book, embraces a more extended view of those substances of importance in the arts, as Sulphuric Acid, Iodine, Carbonate of Soda, Chloride of Lime, etc.; and of the practice of alkalimetry and chlorimetry.

The author has placed the description of the salts of each metal, immediately following that of its binary compounds, which presents the whole subject at one view, and facilitates reference.

Part third treats of Organic Chemistry. A condensed account of organic analysis, the doctrine of substitutions of

Dumas, the action of ferments, and the molecular theory of organic compounds, are embraced in a preliminary section; Liebig's method of arrangement under compound radicals has been adopted, which gives greater unity to the subject, and facilitates its study. This part of the work contains much that is new in animal chemistry, and "important conclusions respecting the functions of digestion and respiration, results which are entirely new, and now enter, for the first time, into a systematic work on chemistry."

Under the supervision of its able editor, the text has undergone a careful correction, and, in the form of notes, several important observations, made subsequently to its publication, have been appended. The work contains one hundred and thirty-three illustrations, and, in fine, constitutes a most valuable addition to our chemical literature.

W. P.

ART. XLVI.—ON THE NAPTHA OF DR. HASTINGS.

Dr. Hastings, of England, has recently published statements in relation to the use of Naptha in Phthisis, and as there has been a difficulty in understanding what substance was alluded to, the editor of the London Pharmaceutical Journal has given some judicious remarks in the July number of that periodical. After noticing Naptha proper, pyroxylic spirit, etc., Mr. Bell observes, "Another volatile and inflammable fluid closely resembling, and indeed not easily distinguished from the last described, in its physical characters, is obtained by the destructive distillation of an acetate, as the acetate of lead or lime. This product has been called by chemists, pyroacetic spirit, mesitic alcohol,

or acetone. It resembles alcohol more closely than pyroxylic spirit, having nearly the same density, and is miscible in all proportions with water without producing milkiness. This fluid is also sold under the name of *Naptha.* It is applicable to most purposes for which pyroxylic or wood spirit is used, and is often substituted for the latter. *This is the kind of Naptha which Dr. Hastings uses.*"

As it is probable that this substance will be sought after by physicians it has been thought proper to append the following notice of the mode of preparing it, taken from the excellent work of Graham, viz.: "Acetone may be conveniently prepared by distilling a mixture of two parts of acetate of lead and one of quick lime in a salt-glazed jar, the lower part of the jar being coated with fire-clay, and a bent glass tube half an inch in diameter, adapted to the mouth by a cork, so as to form a distillatory apparatus. The jar is supported in the mouth of a small furnace, by which the lower part of the jar only is heated to redness, and the vapors conducted into a Liebig's condenser. The residue is redistilled from quick lime repeatedly, till its boiling point is constant at 132°.

"Acetone is a limpid, colorless liquid, having a peculiar penetrating and slightly empyreumatic odor. Its density in the liquid state is almost the same as that of alcohol, 0.7921, and the density of its vapor being 2022, air being 1000; its taste is disagreeable, and analogous to that of peppermint. It is miscible in all proportions with water, alcohol, and ether. Many salts which are soluble in alcohol and water, are insoluble in acetone, particularly chloride of calcium and hydrate of potash; acetone is separated from water by dissolving such salts in the mixture of these liquids. Acetone is highly inflammable, and burns with a white flame."

The above notice is sufficiently explanatory, and gives a formula easily followed by those desirous of giving it a trial.

W. P.

ART. XLVII.—PHARMACEUTICAL AND TOXICOLOGICAL EXPERIMENTS ON DIGITALIS. By M. Bonjean.

When the powder of the leaves of *Digitalis* is treated by displacement with water, a very bitter solution is obtained, which contains nearly the whole of the active principles. On acidulating, sufficiently, the solution with sulphuric acid, a green resin is separated, in which appears to reside the diuretic virtues of this plant. This resin is insoluble in æther, soluble in dilute alcohol, and the alcoholic solution may be mixed in every proportion with water, without the resin being precipitated, although it is insoluble in water.

Powder of *Digitalis*, exhausted with water, abandons subsequently to alcohol the whole of the chlorophylle, mixed with a fresh proportion of resin, which appears to be of the same nature as that which sulphuric acid throws down from the aqueous infusion of the powder. After this two-fold treatment, the Digitalis is reduced to about half its weight. The powder, exhausted by water and alcohol, only contains a small quantity of a green coloring substance, or chlorophylle, which may be easily isolated by means of sulphuric æther.

One oz. of Digitalis powder furnishes about 18 to 20 grms. of a green resin, and 14 to 15 grms. of chlorophylle. It is to this latter substance that the tincture of Digitalis owes its beautiful green color. It is therefore obvious that this color has not the least influence on the properties of the remedy, and that the tincture will be the richer in green coloring substance the weaker the alcohol employed in its preparation.

To be efficacious as possible, the tincture of Digitalis should be prepared with alcohol of 0.975 to 0.972, and not with alcohol of 0.829 spec. grav., as recommended by all authors.

I consider the aqueous extract to be the most certain and most energetic of all the preparations of this plant.

When powder of Digitalis is acted on directly with æther, the whole of the chlorophylle is extracted, and nothing more. In this manner a tincture of a superb green color is obtained, but entirely deprived of medical properties, contrary to the opinion of MM. Leroyer, of Geneva, Planavia, and others, who regard æther as the best solvent for the active principle of the Digitalis. For my part, I have convinced myself that the æthereal tincture of Digitalis possesses no other properties than those which belong to æther itself.

The author then proceeds to describe several experiments made on some fowls with different preparations of this plant, from which he draws the following remarkable conclusions: "That the purple Digitalis has no injurious effect on fowls, to which very large doses of this plant were administered, either in powder, or in the form of aqueous or resinous extract. The flowers of the fox-glove have no more action, as a poison, on these animals, than the leaves. These results are very remarkable, if we consider that 6 grs. of the powder of Digitalis is sufficient to cause, in the space of from twelve to fifteen hours, the death of a strong dog, (see Orfilas' 'Traité des Poisons,' 3d edit., vol. ii., p. 285;) while 1½ to 2 oz., administered to fowls in the space of twenty-four hours, produce no morbid appearances. It is not possible to assign this inertness to the specimen of Digitalis employed in my experiments, when every day the physicians affirm the efficacy of the same plant, prepared in my laboratory, as a therapeutic agent.

"I had occasion to observe a fact of this kind in numerous experiments which I made on various animals with ergotized rye. Sometimes the oil extracted from this substance acted immediately in a dose of a scruple on fowls, which were narcotized within four to five minutes, and died in the space of a few hours. Sometimes the same oil, extracted from the

same powder, and obtained in the same experiments, had no appreciable effect on these animals, even in the dose of 2, 3, or 4 scruples. In this latter case, the poison produced merely a local irritation, and passed completely, without being absorbed into the evacuations, where the oil was found one or two hours after its injection. M. de Gasparin recently announced to the Academy of Sciences, that arsenious acid was not a poison for sheep affected with pleurisy.* I now announce a fact, which, if not so important in its consequences, is at least as curious; viz., that the purple Digitalis which is poison for man and dogs, has no injurious action o nfowls in a state of health."

Journ. de Pharm. for July, and *Chem. Gaz.*

* This assertion of M. Gasparin was, however, not confirmed by the commission appointed by the Academy of Sciences to inquire into the subject. See this Journal, p. 199. Ed.

ART. XLVIII.—ON THE PREPARATION OF QUINIA AND CINCHONIA. By M. F. C. CALVERT, Preparateur du Cours de Chimie, Appliqué au Jardin des Plants a Paris.

M. CALVERT remarks that similar amounts of the alkalies are not extracted with any regularity from equal weights of cinchona, although of the same quality of bark. This is due to the fact, that lime and the chloride of calcium are capable of dissolving quinia, and it is difficult to avoid using lime in excess.

The same objection may be urged against caustic ammonia and potassa, but not against caustic soda, as this, when added in excess, dissolves neither quinia or cinchonia. Of this insolubility he satisfied himself by repeatedly precipitating mixed solutions of the sulphates of quinia and cinchonia by caustic soda. The solutions, after filtration and saturation with hydrochloric acid, gave no indications of quinia with chlorine and ammonia. Similar solutions, treated in the same manner with soda and hydrochloric acid, gave no evidence of cinchonia with chloride of lime. He therefore concluded that the process of extracting these alkalies by lime was imperfect, and proposes that caustic soda be substituted for it, as all the vegetable bases will certainly be precipitated by it—an object of great importance to the manufacturer.

As the adulteration of sulphate of quinia by sulphate of cinchonia is frequently practised, and not easily detected, it appeared advantageous to be able to employ tests by which this fraud could be easily discovered. M. Calvert recommends the seven following reagents for this purpose:

1. The most approved is the chloride of lime. This precipitates both sulphate of cinchonia and sulphate of quinia; but, in excess, re-dissolves the quinia and not the cinchonia.

The delicacy of this test is such that it produces a precipitate with cinchonia where only one part is dissolved in 1500 parts of water. The sulphate of lime formed at the same time, having sufficient water for solution, does not precipitate.

2. Chloride of calcium does not precipitate sulphate of quinia, but produces a precipitate with sulphate of cinchonia.

3. Sulphate of quinia gives a precipitate with lime water, but is re-dissolved by an excess. The precipitate of cinchonia is not re-dissolved.

4, 5, 6. Ammonia, carbonate of ammonia, and potassa afford similar results.

7. Caustic soda produces a precipitate in both, which is not re-dissolved by an excess of the soda; but the quinia precipitate is pulverulent, and the cinchonia, curdy-white.

By these seven tests it will always be easy to distinguish between quinia and cinchonia, and to detect any admixture of these two bases, but the chloride of lime is that which should be employed when the proportion of cinchonia is very small.

L. Ed. D. Phil. Mag.

ART. XLIX.—AN EFFORT TO REFUTE THE ARGUMENTS ADVANCED IN FAVOR OF THE EXISTENCE, IN THE AMPHIDE SALTS, OF RADICALS, CONSISTING, LIKE CYANOGEN, OF MORE THAN ONE ELEMENT.

BY ROBERT HARE, M.D.

Professor of Chemistry in the University of Pennsylvania.

(*Concluded.*)

40. As respects the three phosphates of water, PO^5+HO, PO^5+2HO, PO^5+3HO, the argument used by Dr. Kane cuts both ways; although, by its employer, only that edge is noticed which suits his own purpose. It is alleged that the difference of properties, in these phosphates, is totally inexplicable upon the idea of three degrees of "hydration;" but that all difficulty vanishes, when they are considered as three different compound salt radicals, oxyphosphionides of hydrogen, PO^6+H, PO^7+2H, PO^8+3H.

41. To me the formation of three compound radicals, by the reiterated addition of an atom, of which five of the same kind were previously in the mass to which the addition is made, seems more anomalous, mysterious, and improbable, than the existence of three compounds of phosphoric acid with water, in which the presence of the different proportions of water is the consequence of some change in the constitution of the elements which is referred to isomerism.

42. No reason can be given why the addition of *one, two,* and *three atoms of oxygen,* to the "radical," should convey a power to hold a proportional number of atoms of hydrogen. Such an acquisition of power is an anomaly.

43. In the case of radicals formed with hydrogen in different proportions, as in acetyl and ethyl, formyl and me-

thyl, the number of atoms of oxygen in the peroxides, is the inverse of the hydrogen in the radical.

44. Ethyl, C^4, H^5, unites, at most, with one atom of oxygen, while acetyle, C^4, H^3, takes three atoms to form acetic acid, C^4, H^3, O^3. Methyl, C^2, H^3, forms, in like manner, only a protoxide, while formyl, C^2, H, takes three atoms of oxygen to constitute formic acid.

45. Besides the three oxyphosphions, of which the formulas are above stated, there would have to be another in the phosphites; so that instead of the hydrated acid, or phosphite of water, being PO^3+HO, it would have to be PO^4+H, a fourth oxyphosphionide of hydrogen.

46. Respecting the new principles which I have been contesting, Dr. Kane alleges, "that the elegance and simplicity with which the laws of saline combination may be traced from them is remarkable," because he conceives, that without an appeal to those principles, the fact that the number of equivalents of acid in a salt are proportionable to the number of equivalents of oxygen in the base, would be inexplicable.

47. Thus, when the base is a protoxide, we have one atom of the protoxide of hydrogen to take its place; when the base is a sesquioxide (two of radical and three of oxygen,) three atoms of the protoxide of hydrogen take its place: if the base be a bioxide, two atoms of the protoxide of hydrogen take its place.

48. I have already adverted to the existence of certain chemical laws, inexplicable in the present state of human knowledge. Among these is that of the necessity of oxidation to enable metallic radicals to combine with acids. But as a similar mystery exists as respects the adventitious property of combining with radicals, which results from the acquisition of an additional atom of oxygen by any of the compounds hitherto considered as anhydrous acids, the new doctrine has in that respect no pre-eminent claim to credence.

49. But if, without impairing the comparative pretensions of the prevailing doctrine, we may appeal to the fact that the acquisition of an atom of oxygen confers upon a radical the basic power to hold one atom of acid, is it not consistent that the acquisition of two atoms of oxygen should confer the power to hold two atoms of acid, and that with each further acquisition of oxygen a further power to hold acids should be conferred?

50. So far then there is in the old doctrine no more inscrutability than in that which has been proposed as its successor. Since if on the one hand it be requisite that for each atom of oxygen in the base, there shall be an atom of acid in any salt which it may form, on the other, in the case of the three oxyphosphions, for each additional atom of hydrogen extraneous to the salt radical, there must be an atom of oxygen superadded to this radical.

51. It being then admitted that, numerically, the atoms of acid in any oxysalt will be as the atoms of oxygen in the base, it must be evident that whenever an oxysalt of a protoxide is decomposed by a bioxide, there will have to be two atoms of the former for one of the latter. For the bioxide has two atoms of oxygen, and requires by the premises two atoms of acid, while the salt of the protoxide, having but one atom of oxygen, can hold, and yield, only one atom of acid. Two atoms of this salt, therefore, whether its base be water, or any other protoxide, will be decomposed by one atom of bioxide; provided the affinity of the acid for the bioxide predominate over that entertained for the protoxide, as when water is the base.

52. It follows, that the displacement of water from its sulphate, adduced by Kane, does not favor the idea that hydrous sulphuric acid is an oxysulphionide of hydrogen, more than the impression that it is a sulphate of water.

53. Of course, in the case of presenting either a sesquioxide, or a trioxide, to the last mentioned sulphate, in other

words, hydrous sulphuric acid, the same rationale will be applicable.

54. The next argument advanced by Dr. Kane is, that *some* of the acids of which the existence is assumed upon the old doctrine, are hypothetical, as they have never been isolated. This mode of reasoning may be made to react against the new doctrine with pre-eminent force, since *all* of the compound radicals imagined by it are *hypothetical*—*none* of them having been isolated.

55. The third argument of the respectable author above named is, that acids display their acid character in a high degree only when in the combination with water.

56. This argument should be considered in reference to two different cases, in one of which all the water held by the acid is in the state of a base, while in the other an additional quantity is present acting as a solvent. So far as water, *acting as a solvent*, facilitates the reaction between acids and bases, it performs a part in common with alcohol, ether, volatile oils, resins, vitrifiable fluxes, and caloric. Its efficacy must be referred to the general law, that fluidity is necessary to chemical reaction. "Corpora non agunt nisi soluta."

57. In a majority of cases, basic water, unaided by an additional portion acting as a solvent, is quite incompetent to produce reaction between acids and other bodies. Neither between sulphuric acid and zinc, between nitric acid and silver, nor between glacial or crystallized acids and metallic oxides, does any reaction take place without the aid of water acting as a solvent, and performing a part analogous to that which heat performs in promoting the union of those oxybases with boric, or silicic acid.

58. It is only with *soluble* acids that water has any efficacy. The difference between the energy of sulphuric and silicic acid, under the different circumstances in which they can reciprocally displace each other, is founded on the nature of the solvents which they require, the one being

only capable of liquifaction by water, the other by caloric.

59. In support of his opinions the author adverts to the fact, that with hydrated sulphuric acid, baryta will combine energetically *in the cold*, while a similar union between the anhydrous vapor and the same base cannot be accomplished *without heat*. But it ought to be recollected, that to make this argument good, it should be shown wherefore heat causes baryta, a perfectly fixed body to unite more readily with an aëriform substance in which increase of temperature must, by rarefaction, diminish the number of its particles in contact with the solid. If the only answer be, that heat effects some mysterious changes in affinity, (or as I would say in the electrical state of the particles,) it should be shown that the presence of water, or any other base, has not been productive of a similar change, before another explanation is held to be necessary. But I would also call to mind that the hydrated acid is presented in the liquid state; and if it be asked why water, having less affinity than baryta, can better cause the condensation of the acid, I reply, that it is brought into contact with the acid both as a liquid and a vapor, of neither of which forms is the earthy base susceptible. But if all that is necessary to convert anhydrous sulphuric acid into an oxysulphionide, be an atom of oxygen and an atom of metal, what is to prevent baryta and anhydrous sulphuric acid from forming an oxysulphionide of barium? All the elements are present which are necessary to form either a sulphate or oxysulphionide; and I am unable to conceive wherefore the inability to combine does not operate as much against the existence of radicals as of bases.

60. I would be glad to learn why, agreeably to the salt radical theory, anhydrous sulphuric acid unites with water more greedily than with baryta, and yet abandons the water promptly on being presented to this base. Why should it form an oxysulphionide with hydrogen more readily than

with barium, and yet display, subsequently, a vastly superior affinity for barium?

61. It seems to be overlooked, that anhydrous sulphuric acid, being the oxysulphion of the sulphites, ought to form *sulphites* on contact with metals.

62. But if the sulphate of water owe its energy to that portion of this liquid, which, by its decomposition gives rise to the compound radical oxysulphion, and not to the portion which operates as a solvent, wherefore in the concentrated state, will it not react with iron and zinc, without additional water, when, with dilution, it reacts most powerfully with those metals.

63. Some stress has been laid upon the fact, that sourness is not perceived, excepting with the aid of water, as if to derive force for the new doctrine from that old and popular, though now abandoned test of acidity; but it should be recollected that it is not the water which goes to form the compound element in the "*hydracids*," erroneously so called, which confers sourness. Will any one pretend that either sulphuric or nitric acid, when concentrated, is sour? Are they not caustic? Can any of the crystallized organic acids be said to have a sour taste, independently of the moisture of the tongue? The hydrated oily acids being incapable of uniting with water as a solvent, have none of these vulgar attributes of acidity. The absence of these attributes in prussic acid would alone be sufficient to render it inconsistent to consider them as having any connexion with the presence of hydrogen.

64. It has been remarked, that liquid carbonic acid does not combine with oxides on contact. To this I would add, that it does not combine with water under those circumstances, but, on the contrary, separates from it like oil, after mechanical mixture: nor does it, under any circumstances, unite with an equivalent proportion of water to form a hydrate. Of course, as it is not to basic water that it is indebted for its ability to become an ingredient in salts, it

cannot be held that this faculty is the result of its previous conversion into an *oxycarbonide of hydrogen*.

65. Chromic acid is admitted not to require water for isolation, and cannot, therefore, be considered as oxychromionide of hydrogen. Yet the oil of bitter almonds, which consists of a *compound radical*, benzule, and an atom of hydrogen, and which is therefore constituted precisely as the salt radical doctrine requires for endowment with the attributes of an "hydracid," is utterly destitute of that acid reaction which hydrogen is represented as peculiarly competent to impart. It follows that we have, on the one hand, in chromic acid, a compound endowed with the attributes of acidity, without being a hydruret of any compound radical; and, on the other, in oil of bitter almonds, a hydruret of a compound radical, without any of the attributes of acidity.

66. The last argument in favor of the existence of salt radicals, which I have to answer, is that founded on certain results of the electrolysis of saline solutions.*

67. On subjecting a solution of sulphate of soda to electrolysis, so as to be exposed to the current employed, simultaneously with some water in a voltameter, Daniell alleges that, for each equivalent of the gaseous elements of water evolved in the voltameter, there was evolved at the cathode

* It is well known that Faraday employed a very simple instrument to ascertain the quantity of the gaseous elements of water yielded in a given time, by a liquid subjected to the voltaic current. It consisted of a graduated tube, through the cavity of which the current was conveyed by wires, so terminating within it, as to have an interval between them through which the current, being conveyed by the electrolytic process, effected the decomposition of the intervening liquid, the resulting gas being caught and measured by the tube. This instrument has been called a volta electrometer, or voltameter.

Faraday found that when various substances were electrolysed, a voltameter being at the same time in the circuit, that for every equivalent of water decomposed within the tube, neither more nor less than an equivalent of the other body could be decomposed.

and anode, not only a like quantity of those elements, but likewise an equal number of equivalents of soda and sulphuric acid. This he considers as involving the necessity, agreeably to the old doctrine, of the simultaneous decomposition of two electrolytic atoms in the solution, for one in the voltameter; while, if the solution be considered as holding oxysulphionide of sodium, instead of sulphate of soda, the result may be explained consistently with the law ascertained by Faraday. In that case, oxysulphion would be carried to the anode, where, combining with hydrogen, it would cause oxygen to be extricated, while sodium, carried to the cathode, and deoxidizing water, would cause the extrication of hydrogen.

68. Dr. Kane, alluding to the experiments above mentioned, and some others which I shall mention, alleges that "*Professor Daniell considers the binary theory of salts to be fully established by them.*"

69. Notwithstanding the deference which I have for the distinguished inventor of the constant battery, and disinclination for the unpleasant task of striving to prove a friend to be in the wrong, being of opinion that these inferences are erroneous, I feel it to be my duty to show that they are founded upon a misinterpretation of the facts appealed to for their justification.

70. It appears to me, that the simultaneous appearance of the elements of water, and of acid and alkali, at the electrodes, as above stated, may be accounted for, simply by that electrolyzation of the soda, which must be the natural consequence of the exposure of the sulphate of that base in the circuit. I will, in support of the exposition which I am about to make, quote the language of Professor Daniell, in his late work, entitled, "Introduction to Chemical Philosophy," page 413:—

"Thus we may conceive that the force of affinity receives an impulse which enables the hydrogen of the first particle of water, which undergoes decomposition, to combine momentarily with the oxygen of

the next particle in succession; the hydrogen of this again, with the oxygen of the next; and so on till the last particle of hydrogen communicates its impulse to the platinum, and escapes in its own elastic form."

71. The process here represented as taking place in the instance of the oxide of hydrogen, takes place, of course, in that of any other electrolyte.

72. It is well known, that when a fixed alkaline solution is subjected to the voltaic current, that the alkali, whether soda or potassa, is decomposed; so that if mercury be used for the cathode, the nascent metal, being protected by uniting therewith, an amalgam is formed. If the cathode be of platinum, the metal, being unprotected, is, by decomposing water, reconverted into an oxide as soon as evolved. This shows, that when a salt of potassa or soda is subjected to the voltaic current, it is the alkali which is the primary object of attack, the decomposition of the water being a secondary result.

73. If in a row of the atoms of soda, extending from one electrode to the other, while forming the base of a sulphate, a series of electrolytic decompositions be induced from the cathode on the right, to the anode on the left, by which each atom of sodium in the row will be transferred from the atom of acid with which it was previously combined, to that next upon the right, causing an atom of the metal to be liberated at the cathode; this atom, deoxidizing water, will account for the soda and hydrogen at the cathode. Meanwhile the atom of sulphate on the left, which has been deprived of its sodium, must simultaneously have yielded to the anode the oxygen by which this metal was oxidized. Of course the acid is left in the hydrous state, usually called free, though more correctly esteemed to be that of a sulphate of water.

74. I cannot conceive how any other result could be expected from the electrolysis of the base of sulphate of soda, than that which is here described. Should any additional

illustration be requisite, it will be found in a note subjoined.*

* It is easy to understand how a simultaneous appearance of oxygen and acid at the anode, and soda and hydrogen at the cathode, may ensue, simply by the electrolyzation of the alkaline base from the following association of formulæ.

Anhydrous sulphuric acid is represented by the usual formula, SO^3; oxygen by the usual symbol, O; sodium by Na; water, acting as a solvent, by HO. Each atom of oxygen, sodium, or acid, is numbered from right to left, 1, 2, 3, 4, so that the change of position consequent to electrolysis may be seen.

Anode	$\overset{1}{O}$	$\overset{2}{O}$	$\overset{3}{O}$	$\overset{4}{O}$	Water. HO	Cathode.
	$\overbrace{Na}^{1}$	$\overbrace{Na}^{2}$	$\overbrace{Na}^{3}$	$\overbrace{Na}^{4}$		
	$\overbrace{SO^3}^{1}$ HO	$\overbrace{SO^3}^{2}$ HO	$\overbrace{SO^3}^{3}$ HO	$\overbrace{SO^3}^{4}$ HO		

Anode.	$\overset{1}{O}$	$\overset{2}{O}$	$\overset{3}{O}$	$\overset{4}{O}$	O	H	*Cathode.*
		$\overbrace{Na}^{1}$	$\overbrace{Na}^{2}$	$\overbrace{Na}^{3}$	$\overbrace{Na}^{4}$		
	SO^3 HO	$\overbrace{SO^3}^{2}$ HO	$\overbrace{SO^3}^{3}$ HO	$\overbrace{SO^3}^{4}$ HO			

As the atoms are situated in the second arrangement, the atom of oxygen (1,) is at the anode, the atom of sodium, $\overbrace{Na}^{1}$, with which it had been united, having been transferred to the second atom of sulphuric acid, which had yielded its sodium to the third atom of acid, $\overbrace{SO^3}^{3}$, this having, in like manner, yielded its sodium to the fourth atom of acid, $\overbrace{SO^3}^{4}$, from which the fourth atom of sodium, $\overbrace{Na}^{4}$, had been abstracted by the electrolytic power. The atom of sodium thus removed from the fourth atom of acid, is represented in union with the oxygen of an atom of water, of which the hydrogen, H, is at the cathode.

75. I will, in the next place, consider the phenomena observed by Professor Daniell, when solutions of potassa and sulphate of copper, separated by a membrane, were made the medium of a voltaic current.

76. Of these I here quote his own account. Philosophical Magazine and Journal, Vol. 17, p. 172:—

"A small glass bell, with an aperture at top, had its mouth closed by tying a piece of thin membrane over it. It was half filled with a dilute solution of caustic potassa, and suspended in a glass vessel containing a strong neutral solution of sulphate of copper, below the surface of which it just dipped. A platinum electrode, connected with the last zinc rod of a large constant battery of twenty cells, was placed in the solution of potassa; and another, connected with the copper of the first cell, was placed in the sulphate of copper immediately under the diaphragm which separated the two solutions. The circuit conducted very readily, and the action was very energetic. Hydrogen was given off at the platinode in a solution of potassa, and oxygen at the zincode in the sulphate of copper. A small quantity of gas was also seen to rise from the surface of the diaphragm. In about ten minutes the lower surface of the membrane was found beautifully coated with metallic copper, interspersed with oxide of copper of a black color, and hydrated oxide of copper of a light blue.

"The explanation of these phænomena is obvious. In the experimental cell we have two electrolytes separated by a membrane, through both of which the current must pass to complete its circuit. The sulphate of copper is resolved into its compound anion, sulphuric acid + oxygen (oxysulphion,) and its simple cathion, copper: the oxygen of the former escapes at the zincode, but the copper on its passage to the platinode is stopped at the surface of the second electrolyte, which for the present we may regard as water improved in its conducting power by potassa. The metal here finds nothing by combining with which it can complete its course, but being forced to stop, yields up its charge to the hydrogen of the second electrolyte, which passes on to the platinode, and is evolved.

"The corresponding oxygen stops also at the diaphragm, giving up its charge to the anion of the sulphate of copper. The copper and oxygen thus meeting at the intermediate point, partly enter into combination, and form the black oxide; but from the rapidity of the action, there is not time for the whole to combine, and a portion of the copper remains in the metallic state, and a portion of the gaseous oxygen es-

capes. The precipitation of blue hydrated oxide doubtless arose from the mixing of a small portion of the two solutions."

77. It will be admitted, that agreeably to the admirable researches of Faraday, there are two modes in which a voltaic current may be transmitted, *conduction* and *electrolyzation*. In order that it may pass by the last mentioned process, there must be a row of anions and cathions forming a series of electrolytic atoms extending from the cathode to the anode. It is not necessary that these atoms should belong to the same fluid. A succession of atoms, whether homogeneous, or of two kinds, will answer, provided either be susceptible of electrolyzation. Both of the liquids resorted to by Daniell, contained atoms susceptible of being electrolyzed. If his idea of the composition of sulphate of copper, and the part performed by the potassa, were admitted for the purpose of illustration, we should, on one side of the membrane, have a row of atoms consisting of oxysulphion and copper; on the other, of oxygen and hydrogen.

78. Recurring to Daniell's own description of the electrolyzing process, above quoted, an atom of copper near the anode being liberated from its anion, oxysulphion, and charged with electricity, seizes the next atom of oxysulphion, displacing and charging an atom of copper therewith united. The cupreous atom thus charged and displaced, seizes a third atom of oxysulphion, subjecting the copper, united with it, to the same treatment as it had itself previously met with. This process being repeated by a succession of similar decompositions and recompositions, an electrified atom of copper is evolved at the membrane, where there is no atom of oxysulphion. Were there *no other anion* to receive the copper, evidently the electrolyzation would not have taken place; but oxygen, on the one side of the membrane, must succeed to the office performed by oxysulphion on the other side; while hydrogen, in like manner, must succeed to the office of the copper.

79. Such being the inevitable conditions of the process, how can it be correctly alleged by Professor Daniell, the transfer of the copper being arrested at the membrane, that as this metal "*can find nothing to combine with,*" it gives up its electrical charge to the hydrogen, which proceeds to the cathode? As hydrogen cannot be present, excepting as an ingredient in water, how can it be said that the copper can discharge itself upon the hydrogen, without combining with the oxygen necessarily liberated at the same time by the electrolytic process? How could the copper, in discharging itself to a cathion, escape a simultaneous seizure by an anion? Would not the oxidizement of this metal be a step indispensable to the propagation of that electrolytic process, by which alone the hydrogen could, as alleged, "*pass to the platinode,*" i. e. cathode?

80. In these strictures I am fully justified by the following allegations of Faraday, which I quote from his Researches, 826, 828:—

"A single ion, i. e. one not in combination with another, will have no tendency to pass to either of the electrodes, and will be perfectly indifferent to the passing current, unless it be itself a compound of more elementary ions, and so subject to actual decomposition."

"If, therefore, an ion pass towards one of the electrodes, another ion must also be passing simultaneously to the other electrode, although, from secondary action, it may not make its appearance."

81. In explanation of the mixed precipitates produced upon the membrane, I suggest that the hydrated oxide resulted from chemical reaction between the alkali and acid, the oxide from the oxygen of the water or potassa acting as an anion in place of that of the oxide of copper; also that the metallic copper is to be attributed to the solutions acting both as conductors and as electrolytes; so that, at the membrane, two feeble electrodes were formed, which enabled a portion of the copper to be discharged without combining with an anion, and a portion of oxygen to be discharged

without uniting with a cathion. In this explanation I am supported by the author's account of a well known experiment by Faraday, in which a solution of magnesia and water was made to act as electrodes at their surfaces respectively.

82. There can, I think, be no better proof that no reliance should be placed on the experiments with membranes, in this and other cases where the existence of compound radicals in acids is to be tested, than the error into which an investigator, so sagacious as my friend Professor Daniell, has been led, in explaining the complicated results.

83. The association of two electrolytes, and the chemical reaction between the potassa and acid, which is admitted to have evolved the hydrated oxide, seem rather to have created difficulties than to have removed them.

84. In this view of the subject, I am supported by the opinion of Faraday, as expressed in the following language:—

> "When other metallic solutions are used, containing, for instance, peroxides, as that of copper combined with this or any decomposable acid, still more complicated results will be obtained, which, viewed as the direct results of electrc-chemical action, will, in their proportions, present nothing but confusion; but will appear perfectly harmonious and simple, if they be considered as secondary results, and will accord in their proportions with the oxygen and hydrogen evolved from water by the action of a definite quantity of electricity."

85. I cannot conceive, that in any point of view the complicated and "*confused*" results of the experiment of Daniell with electrolytes separated by membranes, are rendered more intelligible by supposing the existence of salt radicals. I cannot perceive that the idea that the anion in the sulphate is oxysulphion, makes the explanation more satisfactory than if we suppose it to be oxygen. Were a solution of copper subjected to electrolysis alone, if the oxide of copper were the primary object of the current, the result would be analogous to the case of sodium, excepting

that the metal evolved at the cathode, not decomposing water, would appear in the metallic form. If water be the primary object of attack, the evolution of copper would be a secondary effect.

86. It is remarkable, that after I had written the preceding interpretation of Daniell's experiments, I met with the following deductions stated by Matteuchi, as the result of an arduous series of experiments, without any reference to those of Daniell above mentioned. It will be perceived that these deductions coincide perfectly with mine.

87. I subjoin a literal translation of the language of Matteuchi from the Annales de Chimie et de Physique, tome 74, 1840, page 110:—

"When salt, dissolved in water, is decomposed by the voltaic current, if the action of the current be confined to the salt, for each equivalent of water decomposed in the voltameter, there will be an equivalent of metal at the negative pole, and an equivalent of acid, plus an equivalent of oxygen, at the positive pole. The metal separated at the negative pole will be in the metallic state, or oxidized according to its nature. If oxidized, an equivalent of hydrogen will be simultaneously disengaged by the chemical decomposition of water."

88. Thus it seems, that the appearance of acid and oxygen at the anode, and of alkali and hydrogen at the cathode, which has been considered as requiring the simultaneous decomposition of two electrolytes upon the heretofore received theory of salts, has, by Matteuchi, been found to be a result requiring the electrolysis of the metallic base only, and, consequently, to be perfectly reconcilable with that theory.

89. In fact I had, from the study of Faraday's Researches, taken up the impression, that the separate appearance of an acid and base, previously forming a salt, at the voltaic electrodes, was to be viewed as a secondary effect of the decomposition of the water or the base; so that acids and bases were never the direct objects of electrolytic transfer.

Of Liebig's "Principles," so called.

90. Under the head of the "theory of organic acids," in Liebig's Treatise on Organic Chemistry, we find the following allegations dignified by the name of principles. Manifestly they must tend to convey a false impression to the student, that hydrogen has a peculiar property of creating a capacity for saturation, instead of being only the measure of that capacity, as is actually true, and likewise that in this respect it has a peculiarity which does not exist.

91. The allegations to which I refer are as follows, being a literal translation from the French copy of the Traité of Liebig, page 7:—

"The hydrated acids are combinations of one or more elements with hydrogen, in which the latter may be replaced wholly or in part by equivalents of metals."

"The capacity of saturation depends consequently on the quantity of hydrogen which can be replaced.

"The compound formed by the other elements being considered as a radical, it is evident that the composition of this radical can exercise no influence on the capacity of saturation.

"The capacity of saturation of these acids augments or diminishes in the same ratio as the quantity of hydrogen, not entering into the salt radical, augments or diminishes.

"If into the composition of the salt radical there should be introduced an undetermined quantity of any elements, without changing the quantity of hydrogen extraneous to the radical, the atomic weight of the acid would be augmented, but the capacity of saturation would remain the same."

92. As by the advocates of the existence of "*salt radicals,*" hydrogen is considered as playing the part of a metallic radical, and must, therefore, as respects any relation between it and the capacity of saturation, be in the same predicament as any other electro-positive radical, I cannot conceive wherefore laws, which affect every other body of this kind, should be stated as if particularly associated with hydrogen.*

* There is, in some respects, a coincidence so remarkable as to the part taken by Dr. Kane and myself, with respect to hydrogen, that I

93. Would not a more comprehensive and correct idea be presented by the following language?—

94. From any combination of an acid with a base, either the base or its radical may be replaced by any other radical or base, between which and the other elements present, there is a higher affinity. Of course from acids called hydrated, from their holding an atom of basic water, either this base, or its radical (hydrogen,) may be replaced by any other competent base or radical.

95. The premises being manifestly fallacious, still more so is the subsequent allegation, that in consequence of the hydrated acids being compounds formed with hydrogen,

quote here the language which has been held by us respectively on this subject.

Treating of hydrogen, Dr. Kane uses the following words:—"It was at one time supposed that it shared with oxygen the power of generating acids; and as sulphur, chlorine, iodine, cyanogen, &c., formed one class by combining with oxygen, so they formed a second class, called hydracids, by entering into union with hydrogen." * * * * * * In the year 1832 I proved this view to be incorrect, that all the properties of the compounds of hydrogen combined to show that it was an eminently electro-positive body, that it took place along with iron, manganese, and zinc. * * * * * * * * "These views have been still farther corroborated by the researches of Graham." * * * * * * There rests now, no doubt, in the minds of philosophical chemists, that hydrogen is a metal enormously volatile.

This justifies the following language held in my letter on the Berzelian nomenclature.

"I am of opinion that the employment of the word hydracid, as coordinate with oxacid, must tend to convey the erroneous idea, with which, in opposition to his own definition, the author seems to have been imbued, that hydrogen in the one class, plays the same part as oxygen in the other. But in reality, the former is eminently a combustible, and of course the radical, by his own definition."

So entirely have I concurred in considering hydrogen as an aëriform metal, that, for more than twenty years, I have, in my lectures, accounted for the amalgamation of mercury when electrolysed in contact with sal ammoniac, by inferring ammonia to be a gaseous alloy of two metallic ingredients, hydrogen and nitrogen being both aëriform metals.

their capacity of saturation *depends* on the quantity of this element which can be replaced.

96. Is not this an inversion of the obvious truth, that the quantity of hydrogen present is as the capacity of saturation; and that, of course, the quantity of any element which can be substituted for it, must be in equivalent proportion? Would not a student, from this, take up two erroneous ideas—first, that the capacity of saturation is conferred by the radical, and in the next place, that of all radicals, hydrogen alone can give such a capacity? Is it not plain, that the assertion here made by the celebrated author, would be true of any radical?

97. Passing over a sentence which has no bearing on the topic under discussion, in the fourth allegation we have a reiteration and expansion of the error of those by which it is preceded. We are informed that the "*capacity of saturation augments and diminishes with the quantity of hydrogen which can be replaced,*" which is again an inversion of the truth, that the quantity of hydrogen varying with the capacity, the quantity of any other radical, competent to replace it, must be in equivalent proportion.

98. Is not the concluding allegation a mere truism, by which we are informed, "that if any undetermined quantity of any element should be introduced into the composition of the radical, without changing the capacity (as measured by hydrogen,) the capacity would be found the same when measured by any other radical?"

99. As all that is thus ascribed to hydrogen must be equally true of any other radical, there would have been less liability to misapprehension, had the generic term radical been employed wherever hydrogen is mentioned. But by employing the word radical to designate halogen elements, the advocates of the existence of compound radicals in amphide salts have deprived the word in question of much of its discriminating efficacy. In fact, their nomenclature would confound all ultimate elements under one ge-

neric appellation, and all their binary combinations under another, so that almost every chemical reagent, whether simple or compound, would be a salt or a radical.

100. Before concluding, I feel it to be due to the celebrated German chemist above mentioned, to add, that however I may differ from him as to the acids being hydrurets of compound radicals, I am fully disposed to make acknowledgments for the light thrown by his analytical researches on organic chemistry, and the successful effect of his ingenious theoretic speculations, in rendering that science more an object of study with physicians and agriculturists.

ART. L.—ON THE MODE OF PREPARATION AND THERAPEUTIC PROPERTIES OF ERGOTINE.

By M. Bonjean.

Powdered ergotized rye is treated with water in a displacement apparatus, and the aqueous solution heated over a water bath. By the action of the heat, this solution sometimes coagulates from the presence of a certain quantity of albumen; sometimes not. In the former case, the coagulum is separated by filtration; the liquid evaporated, over a water bath, to the consistence of a clear syrup, to which a large excess of alcohol is then added, which precipitates all the gummy substances; the liquid is then placed aside until all the gum has subsided, and the solution has reassumed its transparence and brightness, when it is decanted and reduced, over a water bath, to the consistence of a soft extract. In the second case, the aqueous solution is brought immediately to a semi-syrupy state, and then treated, as above, with alcohol, in order to obtain the extract

By this process, a very homogeneous, soft extract is obtained, of a reddish-brown color, and of an agreeable odor of roast meat, owing to the presence of ozmazome, and of a slightly piquant and bitter taste, resembling more or less that of spoiled wheat. It forms, with water, a beautiful red solution, perfectly transparent. 500 grammes of ergot afford from 70 to 80 grms. of extract.

Ergotine is a true specific against hæmorrhage in general. It is well known to what inconveniences the use of ergotized rye in medicine was subject; such, indeed, that it was talked of banishing for ever, from therapeutics, this valuable agent, because its good virtues were accompanied with an energetic poison, which it was necessary to guard against. At present, four years of research have enabled me to explain the whole matter; and nothing is now more easy than to separate from ergot the two principles which it contains, which differ entirely in their mode of action, since the one, the ergotine, acts principally on the arterial membranes, while the other, the oil, exerts its action on the nervous centres.

The immediate effects which it produces in the most violent metrorrhagia, will strike every one who shall have tried my ergotine; the most violent vomitings of blood give way in a very little time to its employment, and relapses are generally rare, especially when the precaution has been taken to continue its employment a certain time after cessation of the symptoms. To be convinced, moreover, that the ergotine is the *obstetrical* principle, it suffices to treat the powder of ergot by ether in a displacement apparatus, as long as any soluble matter is taken up by this liquid. In this manner, the whole of the poison, that is, the whole of the oil of ergot and the resin, are removed, and there remains a powder no longer greasy, but gritty like sand; without bad taste; without any poisonous action, and which excites powerfully the uterine contractions, in doses of from 0.4 grms. to 0.5 grms., in all cases of inertia of the matrice,

where the employment of ergotized rye is considered advantageous.

Comptes Rendus, July 17th, 1843, and *Chem. Gaz.*

ART. LI.—EXTRACTA NARCOTICA CUM SACCHARO, AND MOSCHUS CUM SACCHARO, *according* to M. Gauger.

Narcotic extracts are frequently ordered in a pulverulent form, mixed with sugar. As the mixing of them with sugar is accompanied with considerable difficulty, from the alcoholic extract being generally very adhesive, and it is impossible, even with the greatest pains, to scrape the whole from the sides of the mortar and pestle employed—a difficulty which becomes greater when adhesive or resinous substances are added to them, such as *Sulph. Aurat. Antim.*, *Calomel*, *Guaiacum*, and other powders; furthermore, as these extracts are usually administered in very small doses, and it must be of importance to the physician that the patient should receive accurately the quantity ordered,—M. Gauger advises preparing mixtures of such extracts and sugar in the following manner, and keeping them on hand.

Six oz. of alcoholic extract, freshly prepared in summer, are dissolved in a sufficiently large mortar of porcelain and glass pestle, the weight of which has been previously taken, in from ʒxiv. to ℥ij. of alcohol of 0.815 to 0.793 spec. grav., and then two and a half pounds of pulverized white sugar gradually added under constant stirring. When the whole has been properly mixed, a leaf of blotting paper is tied round the mortar, which is then placed in a moderately

warm situation to dry; the whole is then weighed, and so much powdered sugar added to it as is found requisite to bring the weight of the dried mixture to 3 pounds (troy.) In drying the mixture of the extract and sugar, the alcohol evaporates, and carries with it the water which had remained in the extract, which renders the mixture so much the lighter. The preparation is now pulverized, and passed through a fine hair sieve. Six grains of the powder contain exactly one grain of extract. It keeps exceedingly well in a dry situation, even when the air has access.

Extract, mixed with sugar in this manner, may be dispensed very easily and quickly, and it may be readily mixed with other substances; it may, moreover, be kept for years, and in a cool place, without spoiling.

M. Gauger recommends the preparation of Musk in the same manner, by rubbing one ounce of musk with an ounce and a half of alcohol, as before, and then triturating with 3 ounces of sugar, drying, and again pulverizing. Six grains of this powder represent one of musk, and in such a form as to be instantly available for administration.

Gauger's *Repertorium*, 1842, p. 453, and *Chem. Gaz.*

ART. LII.—DESCRIPTION OF A VERY SIMPLE PROCESS FOR PREPARING HYPO-SULPHITE OF SODA.

By M. Walchner.

Having received an order for several pounds of this salt, which has of late come into very extensive use, both for preparing, as well as for gilding, Dauguerreotype portraits, I was induced to search for a more simple method of preparing it than that generally followed. I found that this salt may be obtained in a very short time, and in great quantity, by the following simple process:—Pure crystallized carbonate of soda is dried as much as possible, and reduced to a fine powder; one pound of it is then mixed with ten oz. of flowers of sulphur, and the mixture heated in a glass or porcelain dish, gradually, until the sulphur melts. The mass, which cakes together, is kept at this temperature, and is divided, stirred, and mixed, in order that each part may be brought into contact with the atmosphere. The sulphuret of sodium formed, passes, under these circumstances, by the absorption of oxygen from the atmosphere, with a slight incandescence, gradually into sulphite of soda. It is dissolved in water; filtered; the liquid immediately boiled with flowers of sulphur; the filtered, nearly colorless, strongly concentrated liquid affords hypo-sulphite of soda, in very pure and beautiful crystals, and in large quantity.

When the mixture is heated too quickly, some sulphur is easily burnt; there then remains a portion of undecomposed carbonate of soda, which contaminates the hypo-sulphite in the first crystallization, but which may very readily be separated from it.

Ann. der Chem. und Pharm., for May, and *Chem. Gaz.*

ART. LIII.—POTATO STARCH.

Dr. Pereira has published in the *Pharmaceutical Journal* some interesting observations on this fecula, which it appears is extensively used in England for adulterating dietetical and pharmaceutical substances, and is sold in the shops under various names.

" At some of the Italian warehouses in London, it is sold under the name of potato-flour; being used by cooks in the preparation of souffles, and sometimes for thickening gravies, sauces, &c., on account of its being cheap, tasteless, and soluble.

" At Mr. Butler's, in Covent Garden market, it is sold in tin canisters, under the name of English arrow-root, and is used as a farinaceous food for infants and invalids, as well as for the preparation of puddings.

" Bright's nutritious farina is a carefully prepared potato-starch, very slightly colored and aromatized. It is used for the same purposes as the preparation last referred to; it makes very agreeable puddings.

" The powder sold as the Prince of Wales' food, prepared by the Patent Farina Company, is potato-starch.

In High Holborn, there is an establishment professing to sell Indian-corn-starch. On examination, Mr. P. found that the substance sold under this name is potato-starch, to which a blue tinge has been communicated, probably by indigo. The naked eye is sufficient to recognize it. By the microscope, the shape and size of the grains, which are very different to those of the real fecula of maize, or Indian corn, readily distinguish it as potato-starch.

" The powder sold as Anderson's soluble starch, is identical with the so-called Indian corn-starch; in other words, it is colored potato-starch.

"Bright's universal sanative breakfast beverage is a mixture of potato-starch and chocolate. To the latter substance it owes its color, odor, and flavor. When prepared for use, with either water or milk, it forms a thickish liquid."

Potato-starch is sometimes used to adulterate West Indian arrow-root; and an imitation sago is sometimes prepared with it. It is also extensively used in England in the manufacture of potato-sugar, which is employed by fraudulent grocers for mixing with the common brown cane sugar.

"In reference to the detection of potato-starch," Dr. P. remarks, "it may be readily distinguished by the naked eye of an experienced person from all other commercial feculas, *tous les mois* alone excepted. It presents a remarkable glistening, satiny, pearly, or sparkling appearance, somewhat like that of a number of minutely divided globules of mercury. Though it is difficult to convey an accurate and precise idea of this property by words, yet it is one which is instantly recognized when a sample of this starch is attentively examined. It arises from the large size of the amylaceous grains. Moreover, potato-starch wants that dull or dead white appearance presented by West Indian arrow-root. It gives the idea of the particles being slightly translucent.

"In the large size and slight translucency of its grains, *tous les mois* agrees with potato-starch; indeed, they are somewhat larger than those of the latter starch. Hence, therefore, the naked eye may confound these two feculas.

"The microscope is the most important agent in distinguishing the different starches from each other; and by it we can readily detect potato-starch. We recognize it by the size, shape, and structure of its grains. Though the size varies somewhat, yet on the average it exceeds that of other commercial starches, always excepting *tous les mois*, whose grains, as I have already stated, are rather larger. I have, however, occasionally met with samples of potato-starch, whose grains nearly equalled in size those of *tous les*

mois. The actual size of the grains varies from 1-600th to 1-30th of a line in diameter. The shape of small (or youngest?) grains of potato-starch is circular, or globular; but that of the larger ones is elliptical, oblong, ovate, or obtusely triangular. Perhaps we may assume that the normal form of the fully developed particles is ovate. The structure of the grains is the next point deserving of our attention. When examined by a polarizing microscope, we observe, by the black cross which they present, that they possess a depolarizing, or doubly refracting, structure, which is to be regarded as an indication of their consisting of a structure unequally dense. By the common microscope, we discover, on some part of the surface of the grain, one hilum, or, in some cases, two hila—one at either end, or two at the same end. The hilum is a circular hole, which was formerly thought to be a kind of umbilicus, by which, according to some writers, the starch-grain was originally attached to the parent vesicle in which it was developed. It is now regarded as the circular section of the tube, or passage, by which the amylaceous substance is introduced into the interior of the starch-grain. On large and old grains of starch we observe a number of cracks which commence at the hilum.

"On the surface of the grains is a series of curved lines, forming a system of either concentric or eccentric rings, or zones, which surround the hilum. They are similar to the curved lines observed on bivalved shells, as the mussel, and which indicate the terminations of the successive layers of which these shells are composed. The grains of every kind of starch, which I have hitherto examined, present a hilum and some traces of rings; but in the smaller grained starches, as rice-starch and the Portland arrow-root (starch of *Arum maculatum*,) they are very imperfectly perceived. *Tous les mois* and potato-starch, probably on account of the size of their grains, show these rings in the most distinct manner.

"The starch grains are composed of a series of juxta-posed concentric layers, which may be compared to the laminæ of an onion. Of these layers, the innermost are the most recently formed. The composition of all of them is the same, but their cohesion is different; the inner or younger ones being less cohesive, and, therefore, more readily soluble than the outer or older ones. The rings, or rugæ, so distinctly perceived on grains of potato-starch, depend on the concentric layers."

ART. LIV.—OBSERVATIONS AND RESEARCHES UPON A NEW SOLVENT FOR STONE IN THE BLADDER. By ALEXANDER URE, A. M., Surgeon to the Western Ophthalmic Institution, Honorary Member of the Pharmaceutical Society.

IN pursuing some inquiries relative to the treatment of certain forms of urinary disease, my attention was directed to the properties of carbonate of lithia, a substance of which no therapeutic application has been heretofore made. It nevertheless occurs as a constituent of various mineral waters; namely, in those of the Kreuzbrunnen of Marienbad, of Klausen, of the Josephsquelle at Bilin, of the Obersalzbrunnen in Silesia, of Lubien in Galicia, of the Kränchen at Ems, and of the Franzensbrunnen at Eger. The four first named waters have, according to Osann, one of the latest and most complete writers on the subject, been found of service in some unhealthy conditions of the urinary organs.*

* *Physiklaisch-medicinische Darstellung der bekannten Heilquellen.* Berlin, 1839, page 94.

Carbonate of lithia dissolves in water at the ordinary temperature of 60° Fahr., to the amount of one per cent. From its sparing solubility it may be said to form the connecting link between the earths and alkalis. It possesses a faintly alkaline by no means unpleasant taste. No opportunity has yet been afforded me of ascertaining whether it passes through the circulation unchanged, although analogy would lead to the supposition that such was the case. It has a remarkable affinity for uric acid; so much so, that if finely pulverized *lepidolite* (a hard siliceous mineral containing three or four per cent. of lithia) be boiled along with uric acid in water, urate of lithia is formed. A fact pointed out by M. Lipowitz, and which has been lately verified by myself.

According to the chemist above mentioned, one part of carbonate of lithia, dissolved in water, and boiled along with an excess of uric acid, dissolves four parts of the latter, which are held in solution after cooling. Urate of lithia is indeed the most soluble salt which that acid forms. It crystallizes by evaporation in the shape of small grains, which require sixty parts of water, at the temperature of 60° Fahr., to dissolve them. It contains 14.4 per cent. of lithia.*

In order to determine the solvent powers of carbonate of lithia, with reference to uric acid and its compounds, at the common temperature of the human body, I instituted the following experiments:

A solution of one grain of carbonate of lithia in an ounce of distilled water was brought to a temperature of 98°, and pure uric acid gradually added in minute portions until it ceased to dissolve. The quantity thus taken up was 2.3 grains. The resulting solution, which remained unchanged the following morning, being saturated with hydrochloric acid, threw down a precipitate of uric acid, amounting to two grains. Now it will be seen, by referring to my paper on the "solvents for calculous concretions," published in the

* Berzelius, *Rapport Annuel.* 1843, page 325.

fifth number of the Pharmaceutical Journal, vol. i., that one grain of crystals of soda, dissolved in an ounce of water, took up only one grain of uric acid—that one grain of carbonate of potash took up 1.4 grains—one grain of borax, 1.2 grains—and four grains of bicarbonate of soda, 1.1 grains. Hence it follows that the solvent power of carbonate of lithia is more than double that of carbonate of soda; nearly double that of carbonate of potash or borax; and about eight times that of bicarbonate of soda, which is the active ingredient of the Vichy water.

A human urinary calculus, now on the table of the Society, composed of uric acid, with alternate layers of oxalate of lime, having been most accurately poised, after being previously brought to hygrometric repose, by digesting in fresh urine, and then carefully dried, was placed in a solution of four grains of carbonate of lithia, in an ounce of distilled water, and steadily maintained at a blood-heat by means of a water bath, during five consecutive hours. On being withdrawn, nicely washed, and again dried as before, it was found to have lost five grains in weight, which is at the rate of one grain an hour. The calculus is deeply eroded in different parts, but the delicate laminæ of oxalate of lime remain intact, imparting to the surface the appearance of deep etching. The menstruum acquired a pale yellow tinge, and there fell down from it, on cooling, a light flocculent deposit of urate of lithia, in which silky crystalline tufts could be discerned by help of the microscope. It was still alkaline to litmus. Decomposed by means of hydrochloric acid, it yielded nearly three grains of pure uric acid.

In another experiment, the remaining half of the same calculus being allowed to stand during four hours in two ounces of the natural Vichy water, from the spring called *Hôpital*, (containing three grains and a half of carbonate of soda,) was found to have parted with two-tenths of a grain of uric acid; while the former portion of the calculus, placed under precisely similar circumstances, at the same time, in

a solution of 1.6 grains of carbonate of lithia to two ounces of distilled water, afforded nine-tenths of a grain of uric acid. Thus is demonstrated the very superior solvent agency of the above feeble lithia solution over the Vichy water.

Half a grain of urate of soda (the ordinary basis of gouty concretions or chalk stones) diffused in an ounce of distilled water at the blood heat, completely dissolved with the addition of one grain of carbonate of lithia, the solution continuing limpid and unaltered; whereas, half a grain of the same urate, in a similar quantity of water at a corresponding temperature, rests apparently unchanged, as may be seen in the two phials before you. Urate of soda, as pointed out in my paper on Gouty Concretions, published in vol. xxiv. of the Medico-Chirurgical Transactions, is about as insoluble as uric acid.

It deserves notice, that when fresh healthy urine is rendered alkaline by carbonate of lithia, no deposition ensues.

A very large proportion of the stones which occur in the urinary bladder of man, are composed in whole or in part of uric acid. Of all the various menstrua hitherto recommended, none appears to promise more favorably than the carbonate of lithia, from the promptitude and energy with which in dilute solution it attacks calculi of this description. If, by means of injection, we can reduce a stone at the rate of a grain or more an hour, as the above experiment would lead us to anticipate, we shall not merely diminish the positive bulk of the calculus, but farther loosen its cohesion, disintegrate it, so to speak, causing it to crumble down and be washed away in the stream of the urine. Cases may present themselves in which it may be expedient to conjoin the use of the lithontriptor; but only occasionally, and at long intervals. It is the frequency of repetition which renders that instrument so hazardous.

It may be presumed, moreover, that the plan of throwing in a weak solution of this kind, would generally exercise a beneficial influence in obviating irritation, by removing the

sharp angular points and asperities of the broken fragments, where the practice of crushing is adopted.

No apprehension need be entertained from the administration of injections if judiciously directed. Sir Benjamin Brodie found that the bladder bore without inconvenience a stream of fluid composed of two minims and a half of nitric acid for each ounce of distilled water. An Austrian surgeon has recently introduced vinegar into the bladder, with excellent success, in an instance of phosphatic calculus. Mons. Lisfranc, the eminent French surgeon, has used in like manner tincture of cantharides for the cure of enuresis; and I myself have thrown a dilute solution of nitrate of silver into the bladder, with the best effect, in cases of chronic catarrh of that viscus.

Nothing has hindered me from trying the carbonate of lithia but its extreme scarcity. I would, therefore, suggest the importance of its preparation to the pharmaceutical chemist. The mineral called *spodumene,* which is found at Killiney, near Dublin, contains, according to Stromeyer's analysis, 5.6 per cent. of lithia.

Lond. Pharm. Journ. and Trans.

ART. LV. COMPARATIVE EXAMINATION OF SEVERAL KINDS OF SARSAPARILLA. By M. Marquart.

The following experiments were made with 250 grs. of each kind:

	Vera Cruz.	*Lisbon.*	*Honduras.*	*Lima.*	*Caraccas.*	*Jamaica.*	*Honduras?*
Amount of extract by infusion............	Grains 25	Grains 14	Grains 12	Grains 36	Grains 16	Grains 28	Grains 26
Colour of the infusion........	Light brown	Reddish brown	Slightly light brown	Very red	Light brown.	Reddish brown	Reddish brown
Amount of extract which dissolves in rectified spirits of wine................	23	10	10	26	12	14	18
The residue contains........................	Sulphates	Sulphates and albumen	....	sulphuric, phosphoric acid, and potash	Gum	Potash and sulphuric acid	Potash
Amount of extract obtained by decoction.	32	26	24	42	22	40	
Colour of the decoction........................	Dark brown	Reddish brown	Light brown	Dark red	Brown	Reddish brown	
Amount of extract which dissolves in alcohol..	25	16	12	28	12	28	
The residue contains........................	Starch	Starch	Starch	No starch	Starch	No starch	

The alcoholic solutions of all the above-mentioned sarsaparillas had, without exception, an acid reaction. Lime-water produced in none an immediate turbidness, even on standing no precipitate, but on boiling a somewhat voluminous sediment, with the exception of the last and that from Lima, which even on boiling afforded but a very slight precipitate. *Oxalate of ammonia* produced in all no opacity, or but a very slight one, and after 24 hours a small white sediment. *Acetate of lead* produced in all the solutions considerable precipitates (with the exception of the first, which was only rendered very turbid, and after 24 hours presented a considerable sediment.) The precipitate was fawn-colored, in the two last of a chocolate color. The following tests gave various results:

	Perchloride of Iron.	*Perchloride of Mercury.*	*Sulphuric Acid.*	*Nitrate of Silver.*	*Caustic Ammonia.*	*Gelatine.*
Vera Cruz.	Dark colouring. After 24 hours, dark colouring.	Very slight turbidness. After 24 hours, opacity and sediment of light brown colour, which subsides very slowly.	No change. After 24 hours, no change.	A slight turbidness. After 24 hours, gray colour, becoming grayish-brown by boiling; on the addition of nitric acid, a yell. wh. precip. sol. in amm.	No change. After 24 hours, no change.	No change. After 24 hours, no change.
Lisbon.	Dark colouring and considerable precip. After 24 hours, a considerable gray sediment.	No turbidness. After 24 hours, opakeness and slight precipitate.	Very faint turbidness. After 24 hours, small precipitate.	Brighter col. and strong precip. After 24 h., consid. yell. wh. precip. soluble in caustic ammonia, not in nitric acid.	No change. After 24 hours, slight sediment.	As above.
Honduras	A blackish-brown coloring. After 24 hours, a blackish-brown color and precipitate.	A slight turbidness. After 24 hours, a heavy sediment attached to the sides of the vessel.	No change. After 24 hours, no change.	Considerable precipitate. After 24 hours, a large whitish-gray sediment, soluble in caustic ammonia.	No change. After 24 hours, a very voluminous precipitate.	As above.
Lima.	Dark brown, nearly black colouring. After 24 hours, blackish-brown colouring and large precipitate.	No turbidness. After 24 hours, a heavy white precipitate.	No change. After 24 hours, considerable voluminous precipitate.	Considerable precipitate. After 24 hours, large white sediment, soluble in ammonia.	No change. After 24 hours, small crystals attached to the sides and bottom of vessel.	A *considerable* precip. After 24 hours the precip. had become attached to the sides of vessel.
Caraccas.	Blackish-brown coloring and precipitate. After 24 hours, dark solution and considerable grayish-brown precipitate.	No change. After 24 hours, a white sediment attached to the vessel.	No change. After 24 hours, a slight precipitate.	Considerable precipitate and brownish-yellow colouring. After 24 hours, large dirty-white precipitate, soluble in ammonia.	No change. After 24 hours, no change.	No change.
Jamaica.	Blackish-brown coloring and large precip. After 24 hours, consid. gray sediment and blackish-brown coloring.	No change. After 24 hours, a heavy white sediment.	Slight opacity. After 24 hours, considerable reddish-brown precipitate.	Considerable precipitate. After 24 hours, considerable flesh-colored sediment, soluble in ammonia.	Darker coloring. After 24 hours, dark brown coloring and slight white sediment.	A precipitate. After 24 hours, had become attached to sides of vessel.
Honduras?	Blackish-brown coloring and large precip. After 24 hours, considerable blackish-brown precipitate.	Slight turbidness. After 24 hours, considerable light sediment.	No change. After 24 hours, considerable chestnut-brown precipitate.	Considerable precipitate. After 24 hours, large sediment, soluble in ammonia.	Darker colouring and precipitate. After 24 hours, slight flesh-coloured precipitate.	A precipitate.

Jahrb. fr Prakt. Chem., vi. p. 40,

MINUTES OF THE PHARMACEUTICAL MEETINGS.

May 1st, 1843.

Dr. Carson in the Chair.

The minutes of the last meeting were read and adopted.

The Journal de Chimie Medicale, for March, the Journal de Pharmacie et de Chimie, for February, and the American Journal of Pharmacy, for April, were laid on the table.

A communication from Augustine Duhamel, on "Camphorated Tincture of Soap," as prepared by the formula of the U. S. Pharmacopœia, was read and referred for consideration to W. Procter, Jr., and H. W. Worthington. The paper was accompanied by two specimens; one made by the formula of the Pharmacopœia, and the other by directions given in the essay.

A specimen of Citrate of Iron was presented by William Procter, Jr., who stated that it was composed of two parts of peroxide of iron, and three parts of citric acid; and that it was a point of great importance in its preparation to avoid a boiling temperature, because the texture, or consistence, of the oxide is thereby changed, and combines less readily with the acid.

A quantity of the fecula of the *Arum triphyllum* was presented by Daniel S. Jones, by whom it was prepared. It had all the good qualities of the Bermuda arrow-root, though less brilliant in its appearance, owing to the granules being more minute.

Several recent tubers of the *Maranta arundinacea* were exhibited to the meeting by William Procter, Jr., who had received them from Bermuda.

Dr. Carson called the attention of the meeting to the subject of the adulteration of olive oil with lard oil. He

had been informed that the latter substance was exported from here to France, and then used as a means of adulterating olive oil, which its character renders it very capable of. The object of the statement was to ascertain if any chemical means were known by which its presence could readily be detected. The subject not having engaged the attention of any members present, was deferred.

Charles Ellis stated that lard oil could be used with olive oil in making lead plaster, but that the product, after some time, acquired a disagreeable odor.

On motion, adjourned.

September 4th, 1843.

Dr. Carson in the Chair.

The minutes of the preceding meeting were read and adopted.

Dr. Bridges, the American Editor of Graham's Chemistry, presented to the College a copy of that work.

William Procter, Jr., on behalf of the commission charged with the remarks of Augustine Duhamel on "Camphorated Tincture of Soap," reported in favor of its publication.

Dr. Carson called the attention of the meeting to a specimen of the fruit of the *Adansonia digitata*, or monkey-bread-tree. It consists of an outer rind, covered with short yellowish hairs, which inclosed a quantity of seeds, embedded in a yellowish pulpy matter.

Also, to a production from the West Indies, called there "Antidote Cocoon;" which is a large flat seed, consisting of a hard shell, inclosing an oily, extremely bitter kernel. This seed is obtained from a large gourd-like fruit, and, when steeped in brandy, the tincture thus formed is used in the West Indies in cases of cholic, cholera, etc. It is the product of the *Feuillia cordifolia*.

William Procter, Jr., presented, for the examination of the members, the fruit of the *Bombyx heptaphylla*, the

down of which is used in the West Indies for stuffing cushions, etc.

The fruits of several other West Indian plants were also exhibited, and, among them, that of the *Cameraria latifolia.* The juice of this tree, when evaporated, is used as a cement. It is also poisonous, like the *Rhus radicans* of this country.

MISCELLANY.

On the kind of death determined by Hydrocyanic Acid, and the Substances which contain it. By Dr. Hayn.—In the observation of cases of poisoning by hydrocyanic acid, which have hitherto been published, the rapidity of death, almost instantaneously supervening, prevented the verification of the reality of certain peculiarities observed by Orfila, Viborg, Krimmer, &c., in their experiments on animals, viz.: that the primary action of hydrocyanic acid especially consisted in a decomposition of the constituent principles of the blood; that the spinal marrow and the vague nerve, were only secondarily affected in their motive functions; and, finally, that the paralysis of the respiratory apparatus was only the result of this pathological modification of the spinal marrow and vague nerve. It is, therefore, not uninteresting to make known a case of poisoning of this kind, in which the slow poisonous effect admitted of the *modus operandi* being ascertained in a very positive manner.

An hypochondriac, of very advanced age, drank one morning about 45 grammes of hydrolate of cherry-laurel. He had had an opportunity of procuring this liquid beforehand, and when symptoms of poisoning manifested themselves, he did not endeavor in any way to deny the cause to which they were due. These symptoms, which did not show themselves until three hours after the poison had been swallowed, were as following:—Paralysis of the hands and feet; head strongly inclined forwards, without it being possible for the patient to hold it erect; involuntary excretion of urine and stools; the extremities, although immovable and cold, had not, however, lost their sensibility; the pulse was small; the voice hoarse, but distinct; the intellectual faculties were perfectly intact.

The patient observed with satisfaction the incessant progress of the weakness which he experienced; notwithstanding all the care lavished on him, he died towards evening, without pain or convulsions, of paralysis of the lungs.

On *post mortem* examination, the blood was found gluey, and of a very peculiar, dark color; but it was impossible to detect the odor proper to

bitter almonds, which, moreover, as is known, is not a constant characteristic. *Hufeland's Journal, from The Chemist.*

Capsules of Copaiba and Rhatany. By Mr. A. J. Cooley.—Ricord has recommended capsules of copaiba, coated with extract of rhatany, as much superior to the common ones of copaiba alone, in the treatment of blennorrhœa. They may be easily prepared by either of the two following methods:—

1. By immersing, for an instant, the common capsules in the following composition; or,

2. By forming the bodies of the capsules with the *composition*, instead of with *gelatine*, and following the same manipulations as for the manufacture of the common gelatine capsules:—

THE RHATANY COMPOSITION.

℞ Ext. rhatan., newly prepared from the root,	3 parts.
Syrup of moist sugar, - - - - - -	1 "
Mucilage of gum Arabic, - - - - -	1 "

Melt the extract and reduce it in a water bath until sufficiently stiff, when cold; do the same with the syrup and gum; then mix them together while hot, but only in such quantity as may be used at one time.

These capsules are said to sit well upon the stomach, the tone of which they contribute to improve. *Ibid.*

Adulteration of Opium.—An Armenian, who had been for many years engaged in the extraction of opium, informed M. Landerer, of Athens, that one of the adulterations of opium consisted in mixing it, in the soft and fresh state, with grapes well crushed and freed from their stones. He assured him that not a single cake of opium comes from the East without having undergone this adulteration.

Another adulteration consists in pounding, in a stone mortar, the epidermis of the capsules and stalks of poppies with white of egg, and in incorporating this mixture, in certain proportions, with opium.

Ibid.

Therapeutical Employment of Vanilla. By Dr. Herschmann.—Dr. Herschmann extols this substance as a medicament, and, according to him, the practitioners of the present age have done wrong in allowing it

to sink into oblivion. He affirms that he is fully convinced of the remarkable effects which may be obtained from its employment in the treatment of adynamic fevers, and especially in cases of hysterics. He prescribes vanilla under the form of infusion, prepared in close vessels, with from 1 to 4 parts of substance to 100 or 150 parts of boiling water. This quantity, properly edulcorated, is administered by spoonfuls in the course of the twenty-four hours.

Sachs's Allgem. Medicin, Central-Zeitung, from Ibid.

Electuary of Turpentine By M. Bouchardat.

℞	Gum Arabic, - - - - - - -	10
	Mix with water, - - - - - - -	10
	Add white honey, - - - - - -	50
	Then, essence of turpentine, - - -	50
	Carbonate of magnesia, - - - -	Q.S.

F. S. A. an electuary of a soft consistence.

To be administered, in the dose of from 2 to 10 grammes per diem, in unleavened bread.

From the example of M. Royer, it is sometimes useful to associate with this formula a small proportion of opium, or Rousseau's laudanum, 10 or 12 drops, which is added to the mucilage, for all the foregoing doses. *L'Expérienca, from Ibid.*

Preparation of Hydrochlorate of Morphia.—M. Michiels, of Antwerp, advises the following process for preparing the hydrochlorate of morphia. He obtained, by ten ounces, more of the salt from 50 kilogrammes of opium than he would have procured by Gregory's process. Ten kilogrammes of opium are treated with a sufficient quantity of cold water by the displacement method. The opium having been exhausted, and the solution filtered clear, it is concentrated at a moderate heat, until about eight quarts only remain, when a slight excess of a concentrated solution of the chloruret of calcium is to be added. The mixture having been heated for an hour, at 175° F., and continually stirred, the meconate of morphia is totally decomposed, and a white precipitate of meconate of lime takes place, which can be separated by filtration. The liquid is then passed boiling over purified animal charcoal; then concentrated, and a large excess of hydrochloric acid added, by which a confused crystallisation of hydrochlorate of morphia and codeine is very soon obtained. This salt is collected, and pressed. As it is impossible to obtain all the morphia from the syrupy mother-water by a second

crystallisation, it must be diluted with water, and boiled, when the morphia may be precipitated by ammonia diluted with water. This morphia, previously washed, is saturated with diluted hydrochloric acid, and added to the salt previously procured. The whole is then decomposed by ammonia, which precipitates almost all the morphia, leaving the codeine and some morphia in the solution. The precipitated morphia is then saturated with diluted hydrochloric acid, when the narcotine will be separated, unless an excess of acid be used; after which, the liquid having been filtered, and a large excess of hydrochloric acid added, the morphia will speedily crystallise. The collected salt is submitted to the press, and about 3-4ths of a pure white salt will be obtained. The mother-water is again precipitated by ammonia, as at first, and the same process of crystallisation is adopted. It is so speedy, that it can be practised several times in a day; whereas, previously, a day was required for each crystallisation. If other salts of morphia are required, the solution of the hydrochlorate must be decomposed by diluted ammonia. *Ibid.*

Acetic Extract of Cantharides. By M. Soubeiran.—The acetic extract of cantharides has been long used in Germany, and is considered as the best and most efficacious preparation yet made. This preparation is made in the following manner: take 4 parts, by weight, of cantharides powder; 1 part of concentrated pyroligneous acid, and 16 pints of alcohol; digest at a temperature of about 90°; express the fluid; filter and distil off the alcohol at a gentle heat. A syrup-looking extract, of a buttery consistence, is left—the acetic extract of cantharides. It is powerfully vesicant. It is only necessary to spread a thin film over paper, and apply it directly to the skin, when it rapidly causes free and full vesication. The presence of the acetic acid in this preparation prevents the cantharadine from crystallising—a circumstance which is a great inconvenience in the etherial extract, rendering its application not always certain. *Edin. Med. and Surg. Journ., from L'Expèrience.*